PAVING AND MUNICIPAL ENGINEERING.

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Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

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The columns of this publication are open to the discussion of all subjects relating to paving, sewerage, water-works, street-lighting, and the physical improvement of cities. Practical information as to the merits of materials used in such work and new methods, with photographs and drawings, which may be used for illustration, are especially desired. We are glad to get brief notes as to proposed improvements and the letting of large contracts.

City engineers are requested to send us as early as possible copies of their annual reports, which will be given proper notice.

Articles relating to methods of road making and maintenance are invited.

AN ARGUMENT IN FAVOR OF BRICK FOR STREET PAVING.*

By Major Hoyt Sherman.

BY the last official census Iowa contained seven cities of the first class, sixty-four of the second class, and six hundred and forty-three towns under two thousand and over two hundred in population, organized or entitled to organize as incorporated towns. For the purposes of this paper, I prefer to make but two classes in the matter of the street paving and sewerage. In the first class I include all cities and towns having one thousand and over in population, numbering one hundred and sixty-seven, and in the second class all towns between two hundred and one thousand in population, numbering five hundred and forty-seven.

It is with the first class, as I have classified them, including probably near two hundred towns, that the question of the proper kind of street pavement assumes a present and pressing form. These are mainly thriving, growing county seats and other commercial centers, with an energetic, aggressive population, all ambitious for growth and to secure the largest possible area of trade.

What constitutes a good pavement, and how best can it be secured?

These questions have been written up so generally that I can only go over ground already discussed by others.

First. Its surface should be such as to give horses passing over it a sure footing, and at the same time secure an easy and, as near as possible, noiseless traction for vehicles.

Second. It must be constructed of durable materials, capable of sustaining heavy loads, and so formed as to secure rapid and effective surface drainage.

Third. It must be of such material and construction that it can be temporarily taken up for purposes of reaching underground drains or other pipes, and replacing, or for ordinary repairs.

And lastly, having in view the uses to which it is put, it must be economical in material and construction, at least so far as to secure a reasonable return for its cost.

No form of wooden pavement has proven practicable—neither the old way of laying heavy plank on stringers, nor the so-called Nicholson, nor the cedar block, so popular only a few years ago—all are dead failures. The granite block, with or without pitch joints, is too noisy, offers an insecure footing for horses' feet, and is too expensive for any general use. It might be laid in limited spaces around freight houses, or before the stores of wholesale dealers in heavy merchandise, but can not be considered for any ordinary use. The asphalt, whether laid in sheet or block form, is too costly, and will not resist the action of our climate. Even slight checks on the surface fill with moisture which expand with frost, and soon break up the surface. Breaks caused by freezing, or made necessary to reach underdrains can never be thoroughly repaired with new material. The new and the old will not make a firm joint. The same objection holds good with the cement pavement, as to difficulty in repairing breaks, and in addition, during periods of ice and snow, it gives a very insecure footing for horses. Towns with convenient access to deposits of limestone of the right kind for macadam can cover their streets with that at a less expense than perhaps any other material. For residence streets it has a few objections, notably that of dust in this windy country, and for business streets it can be made very serviceable with frequent repairs. Wherever used, good underdrainage is a necessity.

We come now to the material that has more than any other the essential qualities for a good pavement, with less of the defects and objections; that is, well burned, vitrified paving brick. This pavement is constructed of two materials, the sand which is found in all parts of the state and nearly everywhere in great abundance, and the clay and fuel to burn it are equally well distributed. The raw material for nearly every other form of pavement has to be brought from outside the state; that for the brick pavement is to be found well distributed within our limits. With the raw material converted by home labor into the manufactured product, and

*A paper read before the Iowa Good Roads Convention, on August 15, 1892.

that also by home labor formed into the complete pavement, it is reasonable to conclude that it would be the most economical to the property owner who pays for it, as well as to the general public that uses and should keep it in repair, having in view its lasting qualities as well as other advantages gained in its daily use.

Having given my judgment as to the material, a few statements on method of construction are in order. Growing cities should recognize as the first step towards good street pavements a thorough and complete system of sewerage. That is essential, and should be first adopted and built, all attachments for house and surface drainage made, and the loose earth in the ditches settled.

The curbing, either of stone or cement, should be in lengths not exceeding four feet; twenty-four inches in depth, and six inches thick at top, and set on the lines of the pavement at such height that it will stand with a facing of seven or eight inches above the surface of the finished pavement against it. The surface then being graded and crowned, the roadway is ready for the pavement proper.

If it is to be on a business street over which the traffic is heavy, the best authority calls for a concrete foundation formed of hydraulic cement, sand and broken limestone thoroughly settled, so that when completed and rolled it shall be fully six inches thick, and its surface conform in curve to the finished work, and then two inches of clean, sharp sand, followed by the top course of brick laid edgewise, running evenly from curb to curb, care being taken to break joints in all the brick work. After the course of brick is laid, the joints should be carefully filled with a composition in equal parts of paving cement and gilsonite, put in when the brick are dry, poured from a bucket with a narrow spout so as to fill each joint, the composition being first heated to a high temperature. This will make the surface water-tight and prevent damage to the pavement in freezing weather. After the composition is applied, cover with an inch coating of clean sand, and there will be a complete and solid arch of pavement twelve inches in thickness, and extending from curb to curb.

Where the pavement is intended only for the usual light street traffic substitue for the cement course a layer of clean water-washed sand, four inches in thickness, followed by a layer of brick laid flat, then one inch of clear sand, finished up with a top course of brick laid edgewise, with joints filled with cement and the coating of sand as above.

The quality of material entering into the construction of such pavement is very important. The sand should be clear water-washed and of uniform coarseness of grain. If it should be alternately coarse and fine in different places, there would be inequality in its displacement. Where the cement foundation is used, the best quality of hydraulic cement should be required, laid on a well surfaced bed, made of uniform thickness, and thoroughly settled, and its face should correspond in slope and cross-section to the finished surface of the pavement

There is no standard size of brick, either for paving or other purposes, so far as persistent inquiry can develop. Each manufacturer has his own and sizes vary in length, width and breadth. The paving brick now furnished by the leading manufacturer in this city are 8x3¾x2¼ in size and require 106 brick to lay a square yard of two courses of street pavement. To secure the best possible results, they should be burned uniformly and thoroughly, so as to develop on the surface the partially fused or so-called vitrified appearance and thus make them dense and non-absorbent, and uniform in texture without brittleness. They should be straight, smooth, free from fire cracks, and so dense and solid as not to absorb, in any event, over three per cent. of moisture when immersed for three consecutive days. If these qualities can be secured in a brick of slightly greater length and width, that increase in size should be insisted on.

It is difficult to discuss the cost of such pavements, there being so many and such varied conditions going to make up the sum total—the system of sewerage, the cost and extent of curbing and grading, the distance which the sand has to be hauled, the price of brick and of labor, and many other items varying with locality, season of construction and other causes—all these or similar conditions affect the cost of construction of other forms of pavement as well, so that the cost is only relative, and actual experience will develop the fact that the entire cost of construction of the brick pavement will be relatively the same as other kinds of paving in the same locality, though it may differ materially in different localities.

In the case of towns of less than one thousand and over two hundred in population, and the number as ascertained by the last census is 547, it is probable that the plans adopted or recommended by this meeting for substantial country roads will meet their wants for the streets used for residence purposes. For the streets included in their business centers, pavements substantially the same as those in use by larger towns would be needed with modifications as to sewerage and curbing. Where no permanent system of sewerage is adopted, then ample underdrainage must be provided.

Having the finished pavement the next thing in importance to secure the best results from it is a thorough system of cleaning it. This need not be expensive, yet it would require constant supervision to replace damaged brick, and remove dirt that would otherwise choke a drain or create dust, and to see that no injury results from overloading or narrow tires. Constant vigilance is the price of clean streets, as well as of other good things.

The statutes regulating the paving of cities and towns are elaborate and provide for many different systems of assessing and collecting cost of same. With cities of over 30,000 people the statute provides for direct assessment against abutting property owners of the whole cost of pavement, including intersections and such etcetera under the head of "Incidentals" as municipal authority chooses to add. In cities of over 7,000 another system is adopted and in others of less population still another one. In one place provision is made for improvement by districts, and again bonds issue and their payment provided for by special tax levy. There is no good reason, as far as statutory regulations are concerned, why one system can not be adopted for all cities and towns—not only conferring upon municipal authority the right and power to order such improvements, but to make the provision as to construction, assessment and collecting cost of same. The kind of pavement to be used will vary with the size of town and the service to which it is to be put, but the statute regulating the whole power and duty of municipal governments should be uniform with all. It is to be hoped that the legislature will thoroughly revise the present laws on this subject and wipe out every clause, the repeal of which would lighten the burden of property holders paying for municipal improvements without opening the door for fraud or abuse.

Another very important point to be looked after in arranging a system of street roadways is to guard against making the pavement unnecessarily wide between curbs. Streets vary in width between lot lines from fifty to one hundred feet. From close observation and experience I am convinced that on residence streets the pavement proper need not exceed thirty feet in width. On ordinary business streets a greater width is needed, but not in any case in our western cities to exceed forty-five feet. With that width we can indulge in our well-established custom (more honored in the breach than in the observance) of hitching teams on both sides of the street, and still have a space down the center of thirty feet for general travel both ways. On residence streets the thirty feet space between curbs gives ample room for all street traffic passing over it, and at same time offers excellent opportunity for beautifying the highway proper by parking all of the sides not set apart for sidewalk. On a street of sixty-six feet between lot lines (the ordinary width) using the thirty feet of center for pavement proper and six feet on each side for sidewalk, there will be left between the curb and the sidewalk on either side, a strip of ground twelve feet in width, and with this sodded nicely with blue-grass, and shade trees set out at proper intervals, it will change the thoroughfare from a bare, prosy street to a handsome avenue, adding to the comfort of all passers-by and to the beauty and money value of

adjoining property; and with all this advantage it will lighten materially the cost of construction of the pavement.

There are several other points of importance in reference to street improvements that I have barely time to refer to now, regretting that they can not be discussed more fully without trespassing on the time of others.

First—The pavement being constructed primarily for the public, the public should pay all cost of intersections. Assessing the cost to owners of abutting property is unjust and inequitable—unjust because such abutting owners have no more interest in the intersections than any other member of the general public—inequitable because the total cost of such intersection is always charged to the first pavement laid down, while owners of property on cross-streets pay nothing of it. Take an actual case occurring in this city to illustrate the injustice of it all. On a street front to 293 feet, the actual cost of brick paving, not including curbing, was $887.63; to this was added for intersections, $236.66; for incidentals, $17.29; in all, $1,141.58, the cost of intersections, etc., being thirty per cent. of the cost of the pavement—a gross imposition, the only excuse being that the law gives them the power to do it. This is only one of many similar cases.

Second—Owners of abutting property have no voice whatever in determining the kind and cost of pavement. This is done by representatives of the public who have the power under present laws and who may through lack of information, or in the spirit of experiment, order one pavement after another to the point of confiscation. After the property owner has paid for one pavement as ordered he should be relieved of all cost of repair or future replacement.

Third—No plumber or representative of a water, gas, or street railway company, or other person, should be permitted to tear up or disturb any pavement except under the personal supervision of an official selected for the purpose and the extent and time of such disturbance controlled by proper regulation, and the service of such official paid for by the person or company interested.

Fourth—No vehicles of any character drawing heavy burdens should be permitted, under severe penalties, to use the pavement without felloes and tires on such vehicles at least four inches in width. Every teamster using public streets and drawing heavy loads would, to secure smooth, solid and substantial pavements, cheerfully comply with such a regulation as a matter of economy in the wear and tear of both his team and vehicle; and in case he refused, like the small boy in the story, he should be made to do it.

I have great faith to believe that the increased interest on the subject of public roads will extend also to the improvement of streets in our cities and incorporated towns, and crystallize into substantial results.

PRODUCTION OF ASPHALTUM IN THE UNITED STATES.

E. W. Parker.

THE production of asphaltum and its allied mineral, bituminous rock, in 1889 was limited to California, Kentucky and Utah. The commercial product in 1890 was also confined to those localities. Ohio produced 600 tons, but the product was not marketed during the year and is not considered in the total. The varieties, qualities and values of the several bitumens are so widely different that they might readily be classed as separate minerals. In fact, a new name is usually given to each new discovery. In this manner the names of gilsonite, elaterite, uintite, wurtzilite, albertite, grahamite and a number of others have been bestowed. The latest discovery has been honored with the name of "litho-carbon." It is found a few hundred miles west of San Antonio, Texas, near the line of the Southern Pacific railroad. This has been thought by some to be an entirely new mineral, and great claims have been made regarding its possibilities. What is most strenuously claimed for it, and seemingly with some reason, is that it serves unusually well as the foundation for a paint or varnish for covering metallic surfaces. Thin metal covered with a coating of this varnish may be bent and twisted repeatedly without perceptible crack to the covering and without appearance of peeling off. A company has been organized in New York which claims to have obtained possession of several thousand acres of land on which the new mineral occurs, but with the exception of capitalizing the company no steps have been taken toward developing the property. Nor has it been possible to ascertain the extent of the deposit, and the probable effect its development will have industrially. There can be little doubt, however, that it is like the others, a species of asphaltum. It is found as a fossil limestone impregnated with bitumen, yielding upon refining a good quality of asphaltum which dissolves in turpentine to form varnish. This when dry does not crystallize, but remaining soft and pliable, and possessing strong adhesive qualities will doubtless serve the principal purpose claimed for it. Two unknown quantities must, however, be determined—the amount of available mineral and the cost of production and transportation.

The bituminous rock of California occurs in four different counties—Ventura, Santa Cruz, Santa Barbara and San Luis Obispo. The product of Ventura county is of higher grade than any of the others; that is, it carries a larger percentage of bitumen. The product of the other three counties is used almost exclusively for street paving, it being necessary only to heat the mineral and thoroughly mix the ingredients before spreading. The average price of the product of Santa Cruz and San Luis Obispo counties is from $2.00 to $2.50 per ton. The Santa Barbara product is a grade between this and the Ventura county mineral, and is worth about $4.00 per ton. The Ventura rock is valued at from $10.50 to $12.00 per ton. Some of this is used for street paving, in the preparation of which it is necessary to mix the natural product, while heated, with the sand of the locality where used. A considerable saving in transportation expenses is effected by this means. A considerable part of the Ventura product is refined, and used for a covering for piling, wharf timbers, wood conduits, etc., which it renders practically indestructible by protecting them from the action of air, water, insects, and other destructive agents.

The bituminous rock of Kentucky is not essentially different from the product of Santa Cruz and San Luis Obispo counties in California. It is worth about $2.50 per ton at the mines, which are in Grayson and Hardin counties, and is used for street paving, cellar, warehouse and brewery flooring, and similar purposes.

The product of Utah consists of bituminous rock worth about $7.50 at the mines and "gilsonite," an exceptionally pure form of asphaltum. Gilsonite contains about ninety per cent. of pure bitumen. It is used for making street paving by mixing, when heated, with petroleum, sand and limestone; for paint and varnish by dissolving in turpentine, and as an insulator for electrical wires. Gilsonite is valued at from $50 to $60 per ton at St. Louis, its point of distribution.

The following table shows the annual production of asphaltum and bituminous rock since 1882. Previous to 1888 the output was entirely from California and was consumed in street paving in the large cities. The industry can hardly be considered as having assumed commercial importance until 1888, and in the same year began the production of gilsonite in Utah.

Production of asphaltum and bituminous rock since 1882:

Years.	Short Tons.	Value.	Years.	Short Tons.	Value.
1882	3,000	$10,500	1887	4,000	$16,000
1883	3,000	10,500	1888	50,450	187,500
1884	3,000	10.500	1889	51,735	171.537
1885	3,000	10,500	1890	40,841	190,416
1886	3,500	14,000			

*From Report on Mineral Resources of the United States, just issued under the direction of J. W. Powell, in charge of United States Geological Survey.

The increased value of the product of 1890 as compared with that of 1889 is due to a decreased production of bituminous rock in California and a largely increased output of gilsonite in Utah.

TRINIDAD ASPHALTUM.

Notwithstanding the large proportions which the asphaltum and bituminous rock industry has attained in the West, the bulk of the supply for the United States, in fact nearly all that is consumed in the eastern cities, continues to be procured from the island of Trinidad. This is due to the excessive cost of transportation from our western localities. The European demand is supplied from the bituminous limestone deposits of Neufchatel, Switzerland and Seyssel, France. A limited amount of Neufchatel asphaltum is imported into the United States. The following table shows the imports of asphaltum from 1867 to 1890 inclusive.

Asphaltum imported into the United States from 1867 to 1890:

Years Ended.	Quantity Short Tons.	Value.	Years Ended.	Quantity Short Tons.	Value.
June 30, 1867	.....	$6,268	June 30, 1879	8,084	$39,635
" 1868	185	5,632	" 1890	11,830	87,889
" 1869	203	10,559	" 1881	12,883	95,410
" 1870	488	13,072	" 1882	15,015	102,698
" 1871	1,301	14,760	" 1883	33,116	149,999
" 1872	1,474	35,533	" 1884	36,078	145,571
" 1873	2,314	38,298	Dec. 31, 1885	18,407	88,087
" 1874	1,183	17,710	" 1886	32,565	108,528
" 1875	1,171	26,000	" 1887	30,808	95,735
" 1876	807	23,818	" 1888	36,494	84,045
" 1877	4,532	36,550	" 1889	61,952	138,163
" 1878	5,476	35,932	" 1890	73,861	223,368

Capt. F. V. Greene, of New York City, vice-president of the Barber Asphalt Company, contributed some very interesting information to the census report on asphaltum from Trinidad and other foreign sources. As the figures and statements given by Captain Greene cover also the calendar year 1890, the following is abstracted from his contribution. Some of the information is obtained from the books of his company. Other portions are estimates which, while not derived from positive records, may be considered substantially correct:

IMPORTS OF TRINIDAD ASPHALTUM BY ALL COMPANIES FROM 1880 TO 1890, INCLUSIVE.

Years.	Long Tons.
1880	3 913
1881	6,707
1882	14,263
1883	23,309
1884	19,630
1885	15,289
1886	27,757
1887	26,593
1888	35,137
1889	52,881
1890	54,692
Total	280,171

Pavements of Trinidad Asphaltum.—The number of square yards of Trinidad asphaltum laid in the United States in the past decade is as follows:

NUMBER OF SQUARE YARDS OF TRINIDAD ASPHALT PAVING LAID IN THE UNITED STATES FROM 1880 TO 1890, INCLUSIVE.

Years.	Square Yards.
1880	106,838
1881	116,629
1882	196,184
1883	386,510
1884	424,524
1885	403,882
1886	623,188
1887	799,335
1888	757,101
1889	1,130,863
1890	1,857,000
Total	a6,803,054

a Equivalent to 446 miles of roadway 26 feet wide.

Trinidad asphaltum is being used for street paving in the forty-nine cities in the United States and Canada named in the following list:

CITIES WHERE TRINIDAD ASPHALT PAVEMENTS ARE USED.

District of Columbia—Washington and Georgetown.
Georgia—Savannah.
Illinois—Chicago.
Indiana—Fort Wayne and Indianapolis.
Kansas—Topeka, Wichita and Wyandotte.
Kentucky—Louisville.
Louisiana—New Orleans.
Maryland—Baltimore.
Massachusetts—Boston.
Michigan—Detroit.
Minnesota—Saint Paul.
Missouri—Kansas City, Saint Joseph and Saint Louis.
Nebraska—Omaha.
New Jersey—Newark.
New York—Albany, Binghamton, Brooklyn, Buffalo, Lockport, Long Island City, New York, Rochester, Schenectady, Syracuse, Troy and Utica.
Ohio—Cincinnati, Cleveland, Columbus, Toledo and Youngstown.
Pennsylvania—Allegheny, Altoona, Erie, Harrisburg, Philadelphia, Scranton and Wilkesbarre.
Tennessee—Chattanooga.
Canada—Montreal, Quebec and Toronto.

From the best information obtainable the proportions of Trinidad asphaltum used for different purposes are about as follows:

PROPORTIONS OF USES OF TRINIDAD ASPHALTUM.

	Per cent.
For laying sheet asphalt pavements	72
For manufacturing asphalt blocks and tiles for pavements	24
Total for paving	96
For roofing	3
For all other purposes	1
Total	100

The amount of asphalt blocks manufactured and laid as pavements has varied from 5,000 to 100,000 square yards per annum, and the total from 1880 to 1890, inclusive, is estimated at 500,000.

PAVEMENTS FROM BITUMINOUS LIMESTONE.

About 55,000 square yards of bituminous limestone pavements were laid in Washington, D. C., during 1876 and 1877, and about 3,000 square yards in New York in 1883 or 1884. Nearly all of this was subsequently taken up and replaced by Trinidad asphaltum. In 1887 about 10,000 square yards were laid in Rochester, N. Y.; in 1888, about 20,000 square yards in Saint Augustine, Fla.; and in 1890, 40,000 square yards in New York City. Captain Greene estimates that the total amount of bituminous limestone pavement now in use in the United States does not exceed 75,000 square yards.

ASPHALT PAVEMENTS IN EUROPEAN CITIES.

The asphalt pavements in Europe are all made from the bituminous limestones obtained from the localities mentioned previously in this report. The pavements are found in Berlin, London, Paris, and a few other cities, probably not exceeding ten in all. The total area covered is, approximately, as follows, according to the authorities cited, and it is about one-fourth of that covered by Trinidad asphalt pavements in the United States.

AREAS OF BITUMINOUS LIMESTONE PAVEMENTS IN USE IN EUROPEAN CITIES.

	Sq. Yds.	Authorities.
Berlin	681,486	United States Consular Reports, No. 120.
London	360,000	Reports of paving companies.
Paris	375,360	Annuaire Statisique de la Ville de Paris, 1888, page 26.
Other cities	300,000	Estimated.
Total	1,698,846	

ROAD IMPROVEMENT ASSOCIATIONS IN IOWA AND MISSOURI.

The Good Roads Convention, held in Des Moines, Iowa, on August 15th and 16th, was largely attended. It was addressed by Governor Boies, who expressed the hope that permanent good would come from the gathering. He felt an interest in the discussion for the reason that he wanted to make certain recommendations to the next legislature on the subject. For that purpose he wished to learn from the men who have been studying the problem of better roads all their lives.

Mr. Cummins nominated Judge Thayer as chairman of the convention, crediting him with the organization of the movement. Judge Thayer expressed gratification at the governor's intention to call the attention of the legislature to the subject, then continuing, said:

"It takes money, a good deal of it, to build enough good wagon roads to make any plan practical for all portions of the state. Talk is permissible, and in the establishment of a good system of road-making which shall meet with the approval of the masses, talk is essential. If there are gentlemen present, however, who think this convention, even in the aggregate, possesses the wisdom to formulate a plan which will give the state the good roads imperatively essential to a reasonably fair development of the resources of the state, so that its vast traffic may be conducted in the most economical manner, with the largest possible profit to the farmer, with the least burdens for him to carry and with the greatest comfort and happiness to his home, and also to advance in the best way the material interests and welfare of all the people, without a radical and sweeping change in the method of road building and repairing, and the levying and collecting of road taxes, they either overestimate the brain force of what I see is a brainy convention, or they underestimate the magnitude of the task of building good roads throughout the state."

The speaker urged agitation and active work and that the latter shall commence when it can be shown that 15,000 miles of good roads can be built in five years or at the outside in ten, so that when completed no person in Iowa will be found living more than four miles from a perfect macadamized road, and all this without an increase of tax. He proceeded to outline his plan, which in its main points is as follows:

First—Solicit the aid of the government.

Second—Let the state be asked to take part in the improvement. Five million dollars could easily be spared by this prosperous, wealthy, and growing state and three per cent. bonds could be negotiated.

Third—Authorize the cities to vote aid to the roads and allow the councils to appropriate the money for use in any part of the county instead of as now limiting the expenditure to within three miles of the city limits.

The plan provides for six roads running east and west and six north and south in each county, the estimated average cost being $1,500 a mile. Comparing the present cost of poor roads and that of the proposed good roads, the speaker demonstrated that there would be a great saving. The state could be divided up into three or five road districts, the territory of each to be nearly equal in area. One man could be appointed from each district, these persons to constitute a State Board of Road Commissioners, who shall have the general supervision of the construction of the state roads. The board shall employ an engineer, who shall submit to the board at as early a day as the members shall designate a general plan for the construction of roads in conformity with the requirements of the General Assembly.

The roads should be built in sections of from twenty to thirty miles, longer stretches in one county to be built upon permit of the District Commissioner, but no less than twenty miles to be undertaken at one time, the theory being that twenty miles or more of continuous road can be built cheaper per mile than shorter distances.

J. C. Cummins, N. B. Holbrook, W. O. Mitchell, Eugene Secor, and J. D. Yeomans were appointed by the chair a committee to nominate the committees of the convention. State Dairy Commissioner A. C. Tuper read a paper on the "Influence of Good Roads on the Material Welfare of the State," defining a good road as one that is good all the year, and enables the farmer to market his product when prices are most favorable. He said that bad roads had damaged the creamery and cheese interest of Iowa this year, reducing the farmers' profit 20 per cent.

President Schaeffer of the State University read a valuable paper on the influence of good roads upon the intellectual, moral, and social welfare of the State. He said that good roads would enliven social life in the country and arrest the regrettable tendency of many people to rush to the cities Dr. Schaeffer showed how freedom of intercourse over good roads improves the individual and the community. "Make the life bright on the farm and you will send fewer farmers and farmers' wives to the insane asylum," said he.

Railroad Commissioner Peter A. Dey read a paper upon "Good roads, how best built in Iowa out of Iowa material." The work begun by this convention, he said, will probably go on for a century. It should be begun wisely. If too much is undertaken the people will be discouraged. The good roads of Europe are the work of centuries begun by the Romans. Mr. Dey also spoke of drainage. Gov. Boies asked him to be more specific as to size and depths of tile in drainage. Mr. Dey said he favors tile not less than eight or ten inches and at a depth below frost under the center of the roadway. Delegate Thompson of Humbolt raised a question as to the right of the public to drain roads upon private property. This provoked an interesting and practical discussion.

A permanent organization was formed, and the following named persons were elected directors from the different congressional districts: First, William Stieh, Burlington; Second, Peter A. Dey, Iowa City; Third, J. N. Muncey, Jesup; Fourth, William Larrabee, Clermont; Fifth, James Youel, Cedar Rapids; Sixth, C. F. Blake, Ottumwa; Seventh, J. G. Berryhill, Des Moines; Eighth, W. O. Mitchell, Corning; Ninth, J. C. McCabe, Logan; Tenth, G. L. Tremaine, Humboldt; Eleventh, H. C. Wheeler, Odebolt. Ex-Governor Gear, for the Committee on Resolutions, then reported the following resolutions, which were adopted by the convention:

WHEREAS, The imperfections of the present road laws of Iowa, so far as practical results are concerned, are more manifest year by year; and

WHEREAS, The growing demand of a great state, the necessities of its people, the requirements of its greatly increased population, call with an emphasis that means from our great commonwealth a demand for action, a demand for a change in our present road laws that shall make them more forceful, more fruitful of practical results; and

WHEREAS, At a large delegate convention of the counties, cities and towns of the state, called together to discuss the condition of the common roads of the state, eighty-eight counties and 130 cities and towns in all parts of the state are represented by duly accredited delegates; and

WHEREAS, This large delegation is indicative not only of a deep and widespread interest in the subject, but also of profound dissatisfaction with the existing conditions of our highways and with the operation of our statutes for the working of roads; and

WHEREAS, It is deemed advisable that steps be taken by this convention thus happily convened towards continuing the agitation now begun until it shall result in a permanent system of road betterments; now, therefore, be it

Resolved, That it is the sense of this convention that an imperative need of the people of Iowa at this time is the inauguration at the earliest practicable day of a thorough and business-like system of road improvement, to the end that, so far as the state and its constituent parts can affect the same, the expense of getting the productions of Iowa to market may be reduced to the minimum.

Resolved, That until further legislation can be had the county associations herein contemplated are recommended to take the following steps: (1) To set on foot a movement in every township in their respective counties looking to the consolidation of the road districts in order that said townships may avail themselves of the permission provisions of Chap. 200 of the act of 1884. (2) To impress upon the boards of supervisors the desirability of levying the county road fund tax, provided for in Sec. 1 of the act above mentioned. (3) Where it is apparent the public interest will be best served by a larger immediate expenditure upon the roads than the levy above contemplated, to urge upon the boards of supervisors the propriety of submitting to the people the ques-

tion of voting a higher levy, or the issuance of bonds for the purpose of expediting the improvements contemplated. (4) To agitate, in the cities and towns, the question of the propriety of expending money beyond their limits in improving the highways leading thereto, under the authority given by the statute.

Resolved, That in view of the fact that our present system of collection of road tax in labor has been productive only of disappointment, not alone to the general public interested, but to those in whose immediate interest it is collected, we therefore favor the collection of all road tax, except poll tax, in money.

Resolved, That the thanks of this convention and the people of Iowa are due to Judge E. H. Thayer, our worthy chairman, for the interest and able work in the advocacy of improved road systems in Iowa, and also the gentlemen of the Commercial Exchange of Des Moines for their efforts in behalf of this great cause.

James G. Berryhill made an address on the importance of permanent roads. He thought that drainage is not enough, nor does the entire state need the same system of improvements. He believed in the classification of roads and insisted that the cities and towns must bear a share of the expense of permanent roads. He appealed for more than a dirt road and gave the history of Des Moines paving as showing the value of paving both in itself and as an object lesson to the community.

A resolution was offered by Captain Watrous, of Polk county, in favor of the appointment of a state engineer, with county engineers under him, to supervise and control bridge contracts, which was warmly discussed by Speaker Mitchell, Colscott, Mr. Rhodes, of Henry county, Mr. Redmond, of Monroe, Commissioner Steyh and others, and finally referred to the permanent officers. A resolution offered by Mr. Rhodes, in favor of the boards of supervisors levying one mill tax for a county road fund, was also referred. Delegate S. B. Downing, of Davis county, favored a system of county option in road matters.

A resolution favoring legislation requiring the use of broad tires was referred to the executive committee of the permanent organization. The chairman and secretary of the convention were instructed to call an early meeting of the executive board.

THE MISSOURI ROAD CONVENTION.

The convention of the Missouri State Road Improvement Association was held in Chillicothe at the same time that the Iowa meeting was in session in Des Moines. Delegates were present from nearly every county in the state.

J. L. Erwin spoke on the subject of "Surface and Under-Draining for Common Roads."

An extended discussion followed on the road laws of the state, which showed that amended laws were needed to accomplish the object of this convention. The discussion took a wide range and embraced many phases of the problems of the method of construction, and resulted in the appointment of a committee to arrange suggestions from the delegates and citizens of the state in regard to a change in the road laws of the state. A paper was read by Prof. Elmsly Harris, director of the School of Mines at Rollo, on the "Location of Roads."

The programme consisted of a test of broad and narrow tires of wagons; exhibition by steam road rollers on dirt and macadam roads; picking up and re-making macadam, excavation, earthwork by street-graders and by steam rock-crushers. The result of the broad and narrow wagon-tire contest, each wagon being equally loaded, approximating 4,900 pounds each, resulted as follows:

Width of tire..... .....1½ in.	3 in.	4 in.
Soft earth..... .663½	.473	.461
Grass seed .. .. .347½	.255	.242

The report of the committee appointed to make suggestions was as follows:

"We recommend that roads be classified into three grades or classes. Macadam, gravel or turnpike roads shall be of the first class. Well graded or thoroughly drained dirt roads shall be of the second class, and ordinary ditched or graded dirt roads shall be of the third class. Roads of the first class shall be constructed in sections of not less than one mile in length, upon the petition of a majority of the property-owners abutting the same, and not less than twenty-five per cent. of the costs thereof to be paid by said property-owners or by voluntary subscription. Roads of the second and third classes to be built entirely at the cost of the county. Congressional district or municipal towns, as nearly as practicable, shall constitute road districts, and roads shall be as nearly as practicable located on sectional or subdivisional lines, and when not practicable on these lines then according to the geographical features of the county, and each district shall be in the charge of and under the control of a roadmaster or employe of the county, who shall be employed by and under the control of the county court.

"We recommend that all the dramshop licenses be diverted to the road fund of the respective counties in which they are collected; that the county courts, in addition to a poll tax, be authorized by law to levy and collect a direct tax upon the property of the county not exceeding fifty cents on the one hundred dollars, to be applied to the construction of roads of the second and third classes, and to levy and collect such special tax for the construction of roads of the first class as the voters of the county or any road district or districts thereof may by a vote for that purpose determine; the amount of such tax being within the limit now permitted by the constitution. We would further call the attention of our lawmakers to the enormous amount of money annually expended by our state and the various counties thereof in the payment in cost of criminal cases, and would recommend that our laws in relation to the matter be so amended as to exempt the state from the payment of any costs in criminal cases except for the services of officers, and that the money so saved to the state, together with the tax derived from foreign corporations, be diverted into a general road fund to be distributed to the various counties of the state.

"In view of the difficulty of raising money in the various counties by direct taxation wherewith to build roads, we submit to this convention the proposition of loaning the credit of the state to the various counties to the extent of ten per cent. of the assessed value of the property in said county in the way of a bonded indebtedness for the purpose of building said roads, and a submission of an amendment to our constitution to accomplish that end."

After an exhibition of scrapers, ditchers, loaders, rollers and other kinds of road machinery in the gumbo bottoms of the Grand river, the convention adjourned.

AN INDEX TO THE LITERATURE RELATING TO THE DISPOSAL OF TOWN REFUSE.

By Wolcott C. Foster.

IN the following index all of the articles that required cross indexing have been thoroughly referenced, so that it is thought that no difficulty whatever will be experienced in trying to find the matter relating to any special subject. It will be noticed that where plants exist in various towns, whose name does not appear in the title of the article, that the article has been indexed under the name of the town, as well as under its own special title.

The compilation of this index, which relates almost exclusively to the cremation of town refuse of all kinds, was begun several years ago with the idea of making it absolutely exhaustive up to date. But the author's time has been so occupied that it has been found impossible to carry out this intention to the full extent. However, as a very large amount of literature has been indexed, it is thought that the publication of this matter will be not only of interest, but of value to those engaged in sanitary work and to the members of the various boards of health. Articles marked with * are illustrated:

ALLEGHENY CITY (Pa.), Garbage Furnace at. *Sanitary Engineer*, July 23, 1885, p. 154.

*ANIMAL REFUSE at the Johns Hopkins Hospital Cremation furnace for. *Sanitary Engineer*, July 15, 1886, p. 154.

——OF LARGE CITIES. How to dispose of it. By Col. Jacob L. Storer. *Sanitarian*, Aug., 1873, vol. 1, p. 205. Treats of drying refuse from abbatoirs and converting it into fertilizer. Copied from Boston *Transcript*. Speaks of Hogel's, Chenowith & Baugh's, and Storer's apparatuses.

ANIMAL AND VEGETABLE REFUSE substances in our large cities, Utilization of. By J. S. Schultz, *Sanitarian*, June, 1876, vol. 4, p. 261. A paper read before the American Public Health Association at Baltimore, Nov., 1875. Speaks of feeding refuse to hogs.

*Ashes and other city refuse, The economical disposal of. By Wolcott C. Foster. *Engineering News*, March 15, 1890; *Sanitarian*, May, 1890, vol. 24, p. 395 and on. Treats of the mechanical separation of the commercial and useful constituents of city refuse.

*Attachment for Ranges, Garbage. By Glen Brown. *Sanitary Engineer*, Sept. 16, 1886, p. 374. Treats of a simple attachment to be added to a kitchen range or stove to consume household wastes.

Bartlett Furnace. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. Speaks of Bartlett and many other furnaces.

Baugh & Chenowith Furnace. See under Chenowith & Baugh furnace.

Bee Hive Furnace (or Stafford furnace). *Garbage cremation. *Sanitary Engineer*, Feb. 19, 1885, p. 253. Garbage cremation at Barnley. *Sanitary Engineer*, Jan. 15, 1885, p. 151; May 28, p. 541. Garbage destructor at Richmond (Eng.). *Sanitary Engineer*, Sept. 3, 1885, p. 273. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. Speaks of Bee Hive and many other furnaces. *Refuse destructor at Bombay. *Sanitary Engineer*, Dec. 31, 1885, p. 108. Disposal of Town Refuse. *Sanitary Engineer*, May 14, 1885, p. 499.

Birmingham, Eng., Refuse disposal at. *Sanitary Engineer*, July 31, 1884, p. 193. Speaks of Firman's, Forest's, and Farmer's dryers.

*Bombay, India, Refuse destructor at. *Sanitary Engineer*, Dec. 31, 1885, p. 108. Gives a description of the Beehive furnace.

Bradford, Eng., Garbage and Refuse cremator. *Sanitary Engineer**, Sept. 24, 1885, p. 340; Oct. 8, 1885, p. 373; Nov. 19, 1885, p. 518.
Describes, in Sept. 24, 1885, Healey's furnace.

Brooklyn, Collection of Garbage. *Science*, vol. 8, p. 335.

Buffalo, N. Y., Disposal of Garbage in. *Science*, vol. 12, p. 139.
See also a little squib in the *Iron Age*, April 24, 1890.

Burning Garbage, *Sanitary Engineer*, June 1, 1881, p. 310.
——Furnaces for, *Sanitary Engineer*, Sept. 10, 1885, p. 290.
——Water gas for, at Pittsburgh, Pa. *Sanitary Engineer*, June 18, 1885, p. 51.

*Burning of Town Refuse at Leeds, Eng. *Sanitary Engineer*, Sept. 7, 1882, p. 291. Describes the Fryer furnace.

Burning up Garbage at Milwaukee, Wis. *Sanitary Engineer*, Oct. 23, 1886, p. 500.

Burnley, Garbage cremator at. *Sanitary Engineer*, Jan. 15, 1885, p. 151; May 28, p. 541. Speaks of Beehive furnace.

Byker, Eng., Refuse destructor at. *Sanitary Engineer*, April 12, 1886, p. 250. Speaks of Fryer furnace.

Chenowith & Baugh Furnace. Animal refuse of large cities. How to dispose of it. By Col. Jacob L. Storer. *Sanitarian*, Aug., 1873, vol. 1, p. 205. Speaks of Chenowith & Baugh and several other furnaces.

City Refuse. See under Refuse.

Cocoanut Coir, Cremation of night-soil with. *Sanitary Record*, Sept. 16, 1889, p. 108.

Collection of Garbage in Brooklyn and New York. See under Brooklyn, also New York, also under Garbage, Collection of.

*Cremation Furnace for animal refuse at the Johns Hopkins Hospital. *Sanitary Engineer*, July 15, 1886, p. 154.

Cremation of Garbage. *Science*, vol. 12, p. 211.
——in Minneapolis, Minn. *Science*, vol. 12, p. 139.
*——at Des Moines, Ia. *Science*, vol. 12, p. 365. Describes Engle furnace.
——in New York. *Sanitarian*, vol. 18, p. 141; *Sanitary Engineer*, Feb. 12, 1885, p. 228.
——by Jno. Zellweger. *Scientific American Supplement*, vol. 22, p. 8785.

Cremation in England, Refuse. *Sanitary Engineer*, Feb. 19, 1885, p. 248.

Cremation of Night-Soil with Cocoanut Coir. *Sanitary Record*, Sept. 16, 1889, p. 108.

Cremator at Bradford, Eng. Garbage and Refuse. See under Bradford, Eng.

Cremator at Burnley, Garbage. See under Burnley.

Creamator Cremated, A. *Sanitarian*, vol. 22, p. 358, April, 1889. Describes the burning of a Mann Cremator at Chicago, Ill.

*Cremator, The Foster Garbage and Refuse. See under Foster Garbage and Refuse Cremator.

——Garbage. See under Garbage Cremator.

——Garbage Beehive. See under Beehive Furnace.

——Wanted, garbage. *Sanitary Engineer*, Jan. 8, 1885, p. 133.

Crematory at Wheeling, W. Va., Garbage. *Science*, vol. 9, p. 514.

Des Moines, Garbage cremation at. *Science*, vol. 12, p. 265. Describes the Engle furnace.

Dessication of Garbage. *Science*, vol. 8, p. 301.

Destroyer at Leeds and Hastings (Eng.), Town Refuse. *Engineering News*, Oct. 25, 1890, vol. 24, p. 363. Short note in third column gives figures of cost and receipts.

*Destruction of Garbage by fire. *Sanitary Engineer*, March 1, 1881, p. 164. Speaks of Fryer furnace.

——And Night Soil by fire at Wheeling, W. Va. *Sanitary Engineer*, Dec. 4, 1886, p. 20. Speaks of Smith's furnace.

Destruction of Organic Matter by fire, Garbage furnaces and the. By S. S. Kilvington, M. D. *Sanitarian*, Dec. 1888, vol. 21, p. 482. A paper read before the American Public Health Association at Milwaukee, Nov. 2, 1888. It gives the history of refuse cremation, and describes the following furnaces:
Paddington, Whiley, Fryer, Healey, Wilkinson, Bee Hive, Hickley, Hewes, Hewes & Geary, Reilly, Mann, Bartlett, Smith, Engle, Rider.

*Destruction of Refuse at Governor's Island, N. Y. *Sanitary Engineer*, August 27, 1885, pp. 207 and 211. Describes Reilly's furnace.

*Destructor at Bombay, India, Refuse. See under Bombay.

——At Byker, Eng., Refuse. See under Byker.

Destructors at the Inventions Exhibition, 1885, Refuse. *Sanitary Engineer*, Jan. 7, 1886, p. 133.

Destructor at Richmond, Eng., Garbage. See under Richmond.

Destructor for such as fish, vegetables, and other similar substances. House refuse. By Walter Tupper. *English Patent* No. 15,646 (1889); *Sanitary Record*, March 15, 1890, p. 452. Gives a description of an attachment to ranges, stoves, etc., for burning domestic refuse.

Destructors a possible nuisance, Refuse. *Sanitary Engineer*, April 23, 1887, p. 542.

*Disposal of Ashes and other city refuse, The economical. By Wolcott C. Foster. *Engineering News*, March 15, 1890; *Sanitarian*, May, 1890, vol. 24, p. 395, and on.

Disposal of City Garbage at New Orleans. By Hugh M. Thompson, D. D. *Sanitarian*, Dec. 1879, vol. 7, p. 545; *Scientific American Supplement*, vol. 9, p. 3633.

Excreta in Manchester, Eng. By Dr. Leigh. *Proceedings of the Association of Municipal and Sanitary Engineers and Surveyors*, vol. 2, pp. 20 to 23.

——Garbage. By Dr. L. Laberge. *Sanitarian*, vol. 19, p. 446. Describes Mann furnace.
Science, vol. 9, pp. 309 and 560. Speaks of disposal at Milwaukee, Wis.
Editorial in *Sanitarian*, vol. 14, p. 480. Speaks of a domestic garbage burner.

—— ——In Buffalo, N. Y. *Science*, vol. 12, p. 139.
—— ——In New Orleans. See immediately preceding under Disposal of City Garbage.

——House refuse in London, Eng., Removal and. By D. Richards, Assoc. Sant. Inst. *Sanitary Record*, March 15, 1890, p. 422. A few remarks on the wastefulness of cremation.

——Refuse at Birmingham, Eng. See under Birmingham.

——at Glasgow, Scotland. See under Glasgow.

——Town Refuse, *Sanitary Engineer*, May 14, 1885, p. 499. Describes Bee Hive furnace.

Dispose of Animal Refuse of large cities, How to. By Col. Jacob L. Storer. See under Animal refuse.

Dryer, Farmer's. See under Birmingham.
——Firman's. See under Birmingham. Also see under Firman's Dryer.

Economical Disposal of Ashes and other city refuse, The. See under Ashes.

England, Refuse cremation in. *Sanitary Engineeer*, Feb. 19, 1885, p. 248.

Engle Furnace. Garbage Cremation. *Science*, vol. 12, p. 265. Speaks of Engle furnace, Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. For full description of contents of articles, see under Garbage, Furnaces, etc.

Excreta in Manchester, Disposal of. See under Disposal of excreta, etc.

Farmer's Dryer. *Sanitary Engineer*, July 31, 1884, p. 193. Spoken of in an article on Refuse disposal at Birmingham.

Fertilizing Properties, Improvements in the means or methods of treating or preparing certain refuse matter to increase its. By Wm. Riddiough, *English Patent*, 1,710 (1889); *Sanitary Record*, Jan. 15, 1890. Description of a patent for grinding and crushing night soil mixed with ashes, etc.

Fire, Destruction of garbage by. See under garbage burning, and destruction of by fire, etc.

——, Destruction of Night Soil and Garbage by fire at Wheeling, W. Va. See under Wheeling.

——, Garbage furnaces and the destruction of organic matter by fire. See under Destruction of organic matter by fire, etc.

FIRMAN'S DRYER. Refuse disposal at Birmingham, Eng. *Sanitary Engineer*, July 31, 1884, p. 193, speaks of Firman's dryer. Firman's drying machine. *Proceedings of the Municipal and Sanitary Engineers and Surveyors*, vol. 5, p. 107.

FORREST'S DRYER. Refuse disposal at Birmingham, Eng. *Sanitary Engineer*, July 31, 1884, p. 193, speaks of Forrest's dryer.

*FOSTER GARBAGE AND REFUSE CREMATOR, The. By Wolcott C. Foster, *Engineering News*, March 2, 1889; *Sanitarian*, Aug., 1890, Vol. 25, p. 117.

FRYER FURNACE. *Destruction of Garbage by fire, *Sanitary Engineer*, Mch. 1, 1881, p. 164. *Burning of Town Refuse at Leeds, Eng., *Sanitary Engineer*, Sept. 7, 1882, p. 291. See also a short note in 3d col. p. 363, vol. 24, *Engineering News*, Oct. 25, 1890. Refuse Destruction at Byker, Eng., *Sanitary Engineer*, Apr. 12, 1886, p. 250. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, Vol. 21, p. 482. For further particulars see under Garbage Furnaces.

FURNACES. See under the proper names of the furnaces.
BARTLETT.
BAUGH & CHENOWITH. See under Chenowith & Baugh furnace.
BEE HIVE, or Stafford. See under Bee Hive furnace.
CHENOWITH & BAUGH.
ENGLE.
FARMER. (Dryer.)
FIRMAN. (Dryer.)
FORREST. (Dryer.)
FOSTER.
FRYER.
GEARY. See under Hewes, Hewes & Geary.
HEALEY.
HEWES, HEWES & GEARY.
HICKLEY.
HOGEL.
MANN.
PADDINGTON.
REILLY.
RIDER.
SMITH.
STAFFORD, or Bee Hive. See under Bee Hive furnace.
STORER.
WHILEY.
WILKINSON.

FURNACE AT ALLEGHENY CITY, Pa., Garbage. See under Allegheny City.

*FURNACE FOR ANIMAL REFUSE at the Johns Hopkins Hospital, Cremation. *Sanitary Engineer*, July 15, 1886, p. 154.

FURNACES FOR BURNING GARBAGE. *Sanitary Engineer*, Sept. 10, 1885, p. 290.

FURNACES and the destruction of organic matter by fire, Garbage. By S. S. Kilvington. See Destruction of Organic Matter, etc.

*GARBAGE ATTACHMENT FOR RANGES. By Glen Brown. *Sanitary Engineering*, Sept. 16, 1886, p. 374.

GARBAGE AND NIGHT-SOIL, Destruction of by fire at Wheeling, W. Va. By Geo. Baird. *Sanitarian*, vol. 17, p. 334. Speaks of Smith furnace.

GARBAGE AND REFUSE CREMATOR at Bradford, Eng. *Sanitary Engineer*, Sept. 24, 1885, p. 330; Oct. 8, 1885, p. 373; Nov. 19, 1885, p. 518. Speaks of Healey's furnace.

——*The Foster. By Wolcott C. Foster. *Engineering News*, March 2, 1889. *Sanitarian*, Aug., 1890, vol. 25, p. 117.

GARBAGE BURNING. *Sanitary Engineer*, June 1, 1881, p. 310.

GARBAGE AT MILWAUKEE, Burning up *Sanitary Engineer*, Oct. 23, 1886, p. 500.

GARBAGE IN BROOKLYN, Collection of. *Science*, vol. 8, p. 335.

GARBAGE CREMATION. *Science*, vol. 12, p. 211.

GARBAGE CREMATION AT DES MOINES. *Science*, vol. 12, p. 265. Speaks of Engle furnace.

GARBAGE CREMATION IN MINNEAPOLIS. *Science*, vol. 12, p. 139.

GARBAGE CREMATION IN NEW YORK. *Sanitarian*, vol. 18, p. 141; *Sanitary Engineer*, Feb. 12, 1885, p. 228.

*GARBAGE, CREMATION OF. By Jno. Zellweger. *Scientific American Supplement*, vol. 22, p. 8785.

*GARBAGE CREMATOR. *Sanitary Engineer*, Jan. 22, 1885, p. 170.
*Bee Hive or Stafford. See under Bee Hive furnace.

——AT BURNLEY. *Sanitary Engineer*, Jan. 15, 1885, p. 151; May 28, 1885, p. 541. Speaks of Bee Hive furnace.

——WANTED. *Sanitary Engineer*, Jan. 8, 1885, p. 133.

GARBAGE CREMATORY, Wheeling, W. Va. *Science*, vol. 9, p. 514.

GARBAGE, DESSICATION OF. *Science*, vol. 8, p. 301.

*GARBAGE, DESTRUCTION OF by fire. *Sanitary Engineer*, March 1, 1881, p. 164. Speaks of Fryer furnace.

GARBAGE by fire at Wheeling, W. Va. Destruction of Night-Soil and. *Sanitary Engineer*, Dec. 4. 1886, p. 20. Speaks of Smith's furnace.

GARBAGE DESTRUCTOR AT RICHMOND, Eng. *Sanitary Engineer*, Sept. 3, 1885, p. 273. Speaks of Bee Hive Furnace.

GARBAGE, DISPOSAL OF. By Dr. L. Laberge. *Sanitarian*, vol. 19, p. 446. Describes Mann incinerator.

GARBAGE DISPOSAL. *Science*, vol. 9, pp. 309 and 560. Describes disposal at Milwaukee, Wis.

GARBAGE, DISPOSAL OF. *Sanitarian*, vol. 14, p. 480. Describes domestic garbage burner.

GARBAGE, DISPOSAL OF, IN BUFFALO. *Science*, vol. 12, p. 139.

GARBAGE, DISPOSAL OF AT NEW ORLEANS. By Hugh M. Thompson, D. D. *Scientific American Supplement*, vol. 9, p. 3633; *Sanitarian*, Dec., 1879, vol. 7, p. 545.

GARBAGE FURNACES. *Sanitary Engineer*, Aug. 26, 1886, p. 300.

GARBAGE FURNACES and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. A paper read before the American Public Health Association at Milwaukee, Nov. 2, 1888. It gives the history of refuse cremation, and describes the following furnaces: Paddington, Whiley, Fryer, Healey, Wilkinson, Bee Hive, Hickley, Hewes' Hewes & Geary, Reilly, Mann, Bartlett, Smith, Engle, Rider.

GARBAGE FURNACE AT ALLEGHENY CITY, Pa. *Sanitary Engineer*, July 23, 1885, p. 154.

GARBAGE, FURNACES for burning. *Sanitary Engineer*, Sept. 10, 1885, p. 290.

GARBAGE, Water gas for burning. (Pittsburgh, Pa.) *Sanitary Engineer*, June 18, 1885, p. 51.

GAS FOR BURNING GARBAGE, Water. See preceding subject.

GEARY FURNACE. See Hewes, Hewes & Geary furnace.

GLASGOW, Scotland, Refuse disposal at. *Sanitary Engineer*, Feb. 5, 1885, p. 211.

GOVERNOR'S ISLAND, N. Y., Refuse destruction at. *Sanitary Engineer*, Aug. 27, 1885, pp. 207 and 211. Describes Reilly's furnace.

HASTING'S, Eng., Town refuse destroyer at Leeds and. *Engineering News*, Oct. 25, 1890, vol. 24, p. 363. Short article in third column without heading. Gives figures of cost and receipts.

HEALEY'S FURNACE. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. Garbage and refuse cremator at Bradford, Eng. *Sanitary Engineer*, *Sept. 24, 1885, p. 330.

HEWES, HEWES & GEARY FURNACE. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. For full particulars see under Garbage, Furnace, etc.

HICKLEY FURNACE. See the same reference as for Hewes, Hewes & Geary Furnace.

HOGEL FURNACE. Animal refuse of large cities. How to dispose of it. By Colonel Jacob L. Storer, *Sanitarian*, Aug., 1873, vol. 1, p. 205. For full particulars see under Animal Refuse of Large Cities.

HOSPITAL, CREMATION furnace for animal refuse at the Johns Hopkins. See under Cremation Furnace.

HOUSE REFUSE, DESTRUCTION for, such as fish, vegetable and other similar substances. See under Destructor.

HOUSE REFUSE, Disposal of. By J. P. Spencer, C. E. *Sanitarian*, Jan., 1884, vol. 12, p. 69. Paper read before the Northeastern Sanitary Inspectors' Association at Carlisle, copied from the *Sanitary Record*.

HOUSE REFUSE, Non-removal of. *Sanitary Record*, Feb. 15, 1890, p. 386. English law concerning this subject.

IMPROVEMENTS in the means or methods of treating or preparing certain refuse matter to increase its fertilizing properties. See under Fertilizing Properties.

INVENTIONS EXHIBITION, 1885, Refuse destructors at. *Sanitary Engineer*, Jan. 7, 1886, p. 133.

*JOHNS HOPKINS HOSPITAL, Cremation furnace for animal refuse at the. *Sanitary Engineer*, July 15, 1886, p. 154.

LEEDS, ENGLAND, Town refuse destroyer at. *Engineering News*, Oct. 25, 1890, vol. 24, p. 363. A short note in third column gives figures of cost and receipts. *Burning of Town Refuse at Leeds. *Sanitary Engineer*, Sept. 7, 1882, p. 291. Speaks of Fryer furnace.

LONDON, ENG., Removal and disposal of house refuse in. By D. Richards, Assoc. Sant. Inst. *Sanitary Record*, March 15, 1890, p. 422. A few remarks on the wastefulness of cremation.

MANCHESTER, Eng. Disposal of excreta in. By Dr. Leigh. *Proceedings of the Association of Municipal and Sanitary Engineers and Surveyors*. Vol. 2, pp. 20 to 23.

MANN FURNACE. Disposal of Garbage. By Dr. L. Laberge. *Sanitarian*, vol. 19, p. 446.
Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington. *Sanitarian*, Dec., 1888, vol. 21, p. 482. For full particulars see under Garbage furnaces, etc.

MILWAUKEE, Wis. Garbage disposal. *Science*, vol. 9, pp. 309 and 560.
Burning up garbage at Milwaukee. *Sanitary Engineer*, Oct. 23, 1886, p. 500.

MINNEAPOLIS, Minn. Garbage cremation in. *Science*, vol. 12, p. 139.

NEW ORLEANS, La., Disposal of city garbage at. By Hugh M. Thompson, D. D. *Scientific American Supplement*, vol. 9, p. 3633; *Sanitarian*, Dec., 1879, vol. 7, p. 545.

NEW YORK, N. Y., Collection of Garbage in. *Science*, vol. 8, p. 335.
Garbage cremation in New York. *Sanitarian*, vol. 18, p. 141; *Sanitary Engineer*, Feb. 12, 1885, p. 228.

NIGHT-SOIL AND GARBAGE, Destruction of by fire (at Wheeling, W. Va.). *Sanitary Engineer*, Dec. 4, 1886, p. 20.
——CREMATION of with cocoanut coir. *Sanitary Record*, Sept. 16, 1889, p. 108.

NUISANCE, Refuse destructors a possible. *Sanitary Engineer*, April 23, 1887, p. 542.

NON-REMOVAL of house refuse. *Sanitary Record*, Feb. 15, 1890, p. 386. The English laws relating to this subject.

ORGANIC MATTER. Garbage furnaces and the destruction of organic matter by fire. See under Destruction of Organic Matter, etc.

PADDINGTON'S FURNACE. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. For full particulars see under Garbage Furnaces, etc.

PITTSBURGH, Pa. Water gas for burning garbage at. *Sanitary Engineer*, June 18, 1885, p. 51.

PROFITABLE UTILIZATION OF TOWN REFUSE. By Chas. Elcock. *Proceedings of the Association of Municipal and Sanitary Engineers and Surveyors*. Vol. 2, pp. 31 to 34. Speaks of carbonization of refuse and the Universal Charcoal and Sewerage Company.

RANGES, Garbage attachment for. See under Garbage attachment for ranges.

REFUSE AND GARBAGE cremators at Bradford, Eng. See under Bradford.

REFUSE AT THE JOHNS HOPKINS HOSPITAL, Cremation furnace for animal. See under Cremation Furnace, etc.

*REFUSE AT LEEDS, ENG., Burning of Town. *Sanitary Engineer*, Sept. 7, 1882, p. 291, speaks of Fryer furnace.

REFUSE CREMATION in England, *Sanitary Engineer*, Feb. 19, 1885, p. 248.

*REFUSE CREMATOR, The Foster garbage and. See under Foster Garbage, etc.

REFUSE DESTROYER at Leeds and Hastings, Eng., *Engineering News*, Oct. 25, 1890, vol. 24, p. 363. Short article in 3d column.

*REFUSE DESTRUCTION at Governor's Island, N. Y. *Sanitary Engineer*, Aug. 27, 1885, pp. 207 and 211. Describes Reilly's furnace.

REFUSE DESTRUCTORS A POSSIBLE NUISANCE. *Sanitary Engineer*, Apr. 23, 1887, p. 542.

*REFUSE DESTRUCTOR AT BOMBAY, India. *Sanitary Engineer*, Dec. 31, 1885, p. 108. Speaks of Bee Hive furnace.

—— AT BYKER, Eng., *Sanitary Engineer*, Apr. 12, 1886, p. 250. Speaks of Fryer furnace.

REFUSE DESTRUCTORS AT THE INVENTIONS EXHIBITION, 1885, *Sanitary Engineer*, Jan. 7, 1886, p. 133.

REFUSE DESTRUCTOR for such as fish, etc. See under Destructor for such as fish, etc.

REFUSE DISPOSAL AT BIRMINGHAM, Eng. See under Birmingham.

REFUSE DISPOSAL AT GLASGOW, Scot. See under Glasgow.

REFUSE, DISPOSAL AT HAASE. By J. P. Spencer, C. E. *Sanitarian*, Jan. 1884, vol. 12, p. 69. A paper read before the North Eastern Sanitary Inspectors' Association at Carlisle.

REFUSE, DISPOSAL OF TOWN. *Sanitary Engineer*, May 14, 1884, p. 499. Speaks of Bee Hive furnace.

*REFUSE, The economical disposal of ashes and other city. See under Ashes, etc.

REFUSE. Improvements in the means or methods of treating or preparing certain refuse matter, to increase its fertilizing properties. See under Fertilizing Properties, etc.

REFUSE, NON-REMOVAL OF HOUSE. *Sanitary Record*, Feb. 15, 1890, p. 386. The English law relating to this subject.

REFUSE OF LARGE CITIES, Animal. How to dispose of it. By Col. Jacob L. Storer, *Sanitarian*, August, 1873, vol. 1, p. 205. Treats of drying refuse from abbatoirs and converting it into fertilizer. From an address of Jacob L. Storer before the Boston Society of Arts, April 24, 1873, and published in the *Boston Transcript*. Speaks of Hogel, Chenoweth & Baugh, and Storer machines.

REFUSE, PROFITABLE UTILIZATION of town. See under Profitable Utilization, etc.

REFUSE IN LONDON, Removal and disposal of House. See under London.

REFUSE, UTILIZATION of animal and vegetable refuse substances in our large cities. By J. S. Schultz. *Sanitarian*, June, 1876, vol. 4, p. 261. A paper read before the American Public Health Association at Baltimore, Nov., 1875. Speaks of feeding refuse to hogs.

REILLY'S Furnace. Refuse destructor at Governor's Island, N. Y. *Sanitary Engineer*, Aug. 27, 1885, pp. 207 and 211. Describes Reilly's furnace. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482. For full particulars see under Garbage, Furnaces, etc.

REMOVAL AND DISPOSAL OF HOUSE REFUSE IN LONDON, Eng. See under London.

REMOVAL OF HOUSE REFUSE, NON-. See under House Refuse, etc.

RICHMOND, ENG., Garbage destruction at. *Sanitary Engineer*, Sept. 3, 1885, p. 273. Speaks of Bee Hive furnace.

RIDER FURNACE. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482.

SMITH'S FURNACE. Destruction of night soil and garbage by fire at Wheeling, W. Va., *Sanitary Engineer*, Dec. 4, 1886, p. 20. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D., *Sanitarian*, Dec., 1888, vol. 21, p. 482.

STAFFORD FURNACE. See Bee Hive furnace.

STORER FURNACE. Animal refuse of large cities. How to dispose of it. By Jacob L. Storer, *Sanitarian*, Aug., 1873, Vol. 1, p. 205.

TOWN REFUSE AT LEEDS, Burning of. See under Leeds.

TOWN REFUSE DESTROYER AT LEEDS and Hastings, Eng. See under either Leeds or Hastings.

TOWN REFUSE, Disposal of. See under Disposal of Town Refuse.
——PROFITABLE UTILIZATION OF. See under Profitable Utilization of, etc.

UTILIZATION OF ANIMAL AND VEGETABLE REFUSE substances in our large cities. See under Refuse, Utilization of, etc.

UTILIZATION OF TOWN REFUSE, Profitable. See under Profitable Utilization, etc.

VEGETABLE REFUSE substances in our large cities, Utilization of animal and. See under Refuse, Utilization of, etc.

WATER-GAS for burning garbage (at Pittsburgh, Pa.). *Sanitary Engineer*, June 18, 1885, p. 51.

WHEELING, W. VA. Destruction of Night-Soil and Garbage by Fire. *Sanitary Engineer*, Dec. 4, 1886, p. 20. Speaks of Smith's furnace. Garbage crematory. *Science*, vol. 9, p. 514.

WHILEY FURNACE. Garbage furnaces and the destruction of organic matter by fire. By S. S. Kilvington, M. D. *Sanitarian*, Dec., 1888, vol. 21, p. 482.

WILKINSON FURNACE. See same reference as for Whiley Furnace.

The Chicago Garbage Crematory Company has submitted a proposition to the city to burn a minimum of 60 tons daily at 80 cents per ton, or 120 tons at 75 cents per ton. The company also offered to build and sell to the city a 60-ton per day crematory for $7,500, a 100-ton for $12,000, and a 150-ton at $15,000. An order directing all garbage to be delivered to the company's existing crematory was referred to the finance committee.

THE SYSTEM OF ROAD REPAIRING IN FRANCE.

To the Editor of Paving and Municipal Engineering:

SIR—I read in your last issue in an article entitled "A Traveler's Observations of Streets and Roads in Many Countries," a paragraph on the way French highways are repaired. He says that the repairers literally pass their lives on the roads and actually dwell in their *fourgon*.

Now this astonishes me; as an old French civil engineer and ex-employe of the road and bridges administration, I never have heard of it and do not see the necessity of it either. There are very few spots in France where a man has to go miles for food or bed. Still I do not contest the veracity of W. Lodia. He may have struck an exceptional gang.

The fact is the same, however, that is to say, that France owes

the perfection of her roads more to the care given to their maintenance than to the expense in building them.

Here is a sketch of the regulations of the department having charge of the roads in France: The roads are divided into sections or "*canton*" of such a length as it is supposed one man, alone, can keep in good repair. That man is called "*cantonnier.*" His section varies from 6,500 to 13,500 feet. Out of every six *cantonniers* one, the most intelligent and faithful, is appointed "*chief cantonnier.*" He also has a section, smaller than the others, to give him time to make weekly trips over those under his charge.

Each *cantonnier* is provided with a book and all orders given to to him are given in writing and every day he must write what he has done, etc., etc.

The *cantonnier* scrapes and sweeps the dust and the mud and keeps filling any small depressions in the road-bed as soon as they appear on the surface, being careful to prevent the formation of ruts. This being the rule adopted all over France, it is plain to see that a repairing gang living in a *fourgon* is unnecessary.

ARTHUR LAGRON.

Freeport, Ill., August 20.

HOW THE FARMER LOOKS AFTER THE ROADS.

WE hear a good deal, especially from organizations claiming to represent the farmers, of the desirabilty of government control of railways. Upon the inquiry, what sort of management would probably result, some light may be gained from the picture presented by our country roads, which are everywhere in charge of officials elected by the people, directly responsible to their constituents and peculiarly obedient to public sentiment. The spectacle is not encouraging to the advocates of further experiments in state socialism. Until the people of this country, through their local governments, can produce wagon-roads over which it is possible to drive more than an average six miles per hour, and to haul freights at better rates than twenty cents and upward per ton mile, one would rather not trust them to administer, through more distant agencies, the far more difficult operations of continental transportation.—*Engineering and Mining Journal.*

ABOUT WHITE SIDEWALKS.

SUPERVISOR BURLING, of San Francisco, contends that white sidewalks are injurious to the eyes, and that they should be colored. In a recent argument on the subject before the street committee he said:

"There is nothing so destructive to the eye as the powerful reflection of the sun from the white-surfaced cement sidewalks, and it is impossible to avoid them in a city like San Francisco, where they are used to the exclusion of almost every other kind. Children encounter them on their way to school; they are allowed to play on them in front of residences, and before they attain their majority are compelled to wear glasses or are placed under the care of an optician for some serious eye affliction. When the eye is once affected it requires the most delicate treatment and an operation upon the optic is considered one of the most difficult in the science of surgery."

A NEW KIND OF WOOD-BLOCK PAVING IN PARIS.

A TRIAL is being made in Paris of a new system of wood-paving. It consists of pieces of oak about four inches long, split up similarly to the ordinary firewood and laid loosely on end in fine sand, on a bed of gravel from four inches to four and a half inches in thickness. A layer of fine sand is then spread over them, and they are alternately watered and beaten several times. In about 48 hours the humidity has completely penetrated and caused the wood to swell, and it is claimed that the mass becomes thus absolutely compact and homogeneous and capable of supporting the heaviest traffic.

CRUSHED SEA SHELL PAVEMENTS.

ABOUT six miles of the streets of Savannah, Ga, are now paved with crushed sea shells. It is said that after the shells are once thoroughly crushed and packed the pavement becomes almost as hard as aphalt, and that all that is necessary to keep it in good order is a watering once a day and an occasional shovelful of shells placed where it is beginning to wear away.

WHERE ONE DOLLAR IS BETTER THAN TEN.

To Paving and Municipal Engineering:

I have received more practical knowledge from the $1 invested in PAVING AND MUNICIPAL ENGINEERING than from the $10 invested in other engineering publications.

W. C. HOLBROOK.

Sterling, Ill., August 19, 1892.

PERSONAL.

Mr. W. R. Story has been appointed assistant engineer to the East Side Sewer Commission at Rochester, N. Y.

J. W. Fox, Esq., has been appointed assistant city engineer in charge of sewer construction under Mr. Hoff, city engineer at Newark, N. J.

Mr. W. P. Rounds, civil engineer, formerly superintendent of water-works at La Salle, Ill., is in charge of sewer construction and street paving at Menominee, Mich.

NEW PATENTS.

MR. V. H. LOCKWOOD, patent attorney and solicitor, No. 60 East Market street, Indianapolis, furnishes the following list of patents of recent date of interest to our readers. Copies can be procured of him if desired:

Wood Pavement. No. 480,183. R. D. Dufl, Tacoma, Wash.

Manufacture of Artificial Stone. No. 480,591. J. E. Keseling and C. Fuchs, jr., New York City. Assignors to the Pyrolith Co. of New Jersey.

Brick Machine. No. 480,726. W. Johnston, Armly, Leeds, England.

Hydraulic Brick Press. No. 480,818. J. J. Koch, St. Louis, Mo.

Street Sweeper. No. 481,054. H. F. Palmer, Norwich, Conn.

Brick Machine. No. 481,454. T. T. Wood, St. Joseph, Mich.

Artificial Stone Composition. No. 481,279. J. E. Keseling & C. Fuchs, jr., New York City. Assignors to the Pyrolith Co. of New Jersey.

Artificial Stone Paving Block. Three patents. Nos. 481,352–353–354. F. Haines, Yonkers, N. Y.

Apparatus for Purifying Sewage. Two patents. No. 479,865–866, J. Wilson, New York, N. Y. Assignor to Roman Debes.

Appliance for Ventilating Sewers. No. 480,958. R. McKenzie, Sydney, New South Wales.

Brick. No. 481,700. P. S. Loveridge, Knoxville, Ky.

Brick Pavement. No. 481,756. J. R. Halderman, Normal, Ill.

Service Box for Water or Gas Pipes. No. 479,909. J. W. Hurley, Buffalo, N. Y.

Bridge Flooring. No. 480,483. J. R. Worcester, Waltham. Assignor of one-half to D. H. Andrews, Boston, Mass.

Hinged Expansion Gear for Bridges. No. 480,863. C. J. Weston & H. Rigby, Millwall, England.

Testing Apparatus for Electric Lighting Circuit. No. 480,038. C. H. Rudd, Evanston. Assignor to the Western Electric Co., Chicago, Ill.

Duplex Arc Lamp. No. 480,050. E. P. Warner, Chicago, Ill. Assignor to the Western Electric Co., same place.

System of Electric Lighting. No. 480,372. G. F. Myers, Pittsburg, Pa.

Electric Lighting System. No. 480,375. C. Selden, Baltimore, Md.

Conduit for Electric Wires. No. 480,573. S. H. Flagg, Providence, R. I.

Electric Arc Lamp. No. 480,525. E. A. Sperry, Chicago, Ill. Assignor to the Sperry Electric Co., same place.

Electric Conduit. No. 481,912–913. Two patents. A. Noll, Mt. Vernon, N. Y. Assignor to A J. Tower, Trustee, Boston, Mass.

Safety Coupling for Gas Mains. No. 481,397. A. Garretson, Fall Creek, Ind.

AN erroneous statement recently appeared in some publications to the effect that the plant of J. W. Penfield & Son at Willoughby, Ohio, had been entirely destroyed by fire. A letter from the Messrs. Penfield states that the report was an exaggeration of the fact that a slight conflagration was caused by lightning setting fire to one of their office rooms. They are, they state, as well prepared for business as ever.

Improvement and Contracting News.

PAVING.

Lyons, Iowa, is now agitating the paving question.

The streets of Kasota, Minn., are being turnpiked.

Hampton, Iowa, will do some street paving this year.

Marion, Ind., will be the proud possessor of a boulevard.

Fostoria, Ohio, is agitating the public park question.

Two squares of Church street, Lynchburg, Va. will be paved.

Orange street in the city of Ashland, Ohio, will be paved with brick.

A paving contract at Salem, Ore., has been awarded to C. D. Rynearson & Co. at $27,656.

Eldora, Iowa, is to have a park. It has purchased twenty acres for conversion into same.

The contract has been let for the paving of ten blocks of the principal streets of Creston, Iowa.

Quite a great many of the streets of Des Moines, Iowa, will be repaved with brick on concrete foundations.

At a meeting of the council of Chagrin Falls, O., it was decided to improve the streets with crushed rock.

Fred Hendler, of Wilkes Barre, Pa., will pave Main street with vitrified brick at Plymouth, Pa., for $22,089.

Cement sidewalks will be laid on College avenue between Eleventh and Seventeenth streets, at Indianapolis, Ind.

A turnpike road will be built between Leavenworth and Marengo, Ind., a distance of thirteen and one-half miles.

Salem, Ore., has just made a $27,000 contract to have crushed rock pavement placed on many of its streets.

Washington boulevard, Chicago, is to be re-surfaced from Halsted street to Western avenue with Trinidad asphalt.

The village clerk of Bond Hill, O., will receive bids until September 26th for the improvement of Carthage avenue.

The county commissioners of Martin county, Minn., recently appropriated $3,000 for road and bridge purposes.

The council of Pawtucket, R. I., has appropriated $30,500 for highway work and $14,000 to macadamize Pine street.

North Lafayette street, at Grand Rapids, Mich., has been graded, and will be one of the finest graveled streets in the city.

The streets of Sioux Falls, S. D., are paved with jasper, the hardest stone in the the country, and is quarried near Sioux Falls.

A motion to appropriate $100,000 4 per cent. bonds for street and sewer improvement at Richmond, Va., was unanimously carried.

Fielding & Shepley were awarded the contract for paving East Fourth street, from Broadway to the railway tracks, at St. Paul, Minn., in consideration of $14,100. The work is to be finished by November 1.

W. H. Jones & Sons submitted the lowest bid for macadamizing Genesee street at Rochester, N. Y. Their bid was for $14,077.

A great deal of vitrified brick street paving will be done in Houston, Texas. Grading has been begun preparatory for the paving.

The Western Paving and Supply Company will pave North Alabama street, between Tenth and Fourteenth streets, Indianapolis, Ind.

James Lee was awarded the contract for grading D street from South 28th to South 35th streets at Tacoma, Wash. His bid was for $3,698.

Ferdinand Beyer was awarded the contract for grading Burgess street from Dale street to Western avenue, St. Paul, Minn., at bid of $3,041.

Bay City, Mich., will pave Center avenue with white pine blocks for $45,000. D. J. Kennedy gets the contract for $20,000 less than the estimate.

Beach drive, at Lincoln Park, Chicago, Ill., will be completed between North and Fullerton avenues by November 1st, and will be a marvel of beauty.

Work has been begun on the paving of West Jefferson street at Burlington, Iowa, and the citizens in that section of the town will rejoice greatly when it is completed.

Some twenty-three of the streets of Brooklyn, N. Y., will be repaved. The mayor and city works commissioner decided to use the $1,000,000 in doing the work.

Sealed bids will be received at the office of the city clerk of Defiance, Ohio, until Sept. 21st for paving Clinton street, between Fifth and Williams streets with vitrified brick or block.

The Barber Asphalt Company will pave Tremont street from Fourteenth to Broadway, Denver, Col., and also curb same. The estimated cost of paving and curbing is placed at $28,174.32.

E. M. Ayers has been awarded a contract at Barnesville, Ohio, for the paving of Chestnut street with the second grade Hallwood block, slack foundation and sand filling. It is a $15,000 contract.

Large contracts have been let to three companies for asphalt and asphalt block paving in Washington, D. C. The companies are the Barber, Cranford Paving Co. and Asphalt Block and Tile Company.

At Nashville, Tenn., Printers alley will be paved with vitrified brick by John Lellyett from Church to Broad streets; and the paving of Cumberland alley, from Printers alley to College street and from High to Vine streets will be done by Bush & Co.

Greene county, Ind., has a new ten-mile graveled road between Bloomfield and Lyons. Bloomfield, the county seat, is also bettering the condition of its streets and sidewalks by grading and graveling the same.

The commissioners of Seneca county, Ohio, will macadamize a road leading to Attica. Three rows of tile will be laid under the road, one through the center and one on each side, so as to afford perfect drainage.

The city engineer of Tacoma, Wash., has completed his estimate of the cost of paving Pacific avenue with bituminous rock. His estimate, including the cost of a stone retaining wall at the gulch near Twenty-fifth street, is $70,000.

Work is begun on the new boulevard at at Jersey City, N. J. The Hudson County Freeholders awarded the contract for constructing section No. 1 of the new boulevard to the Hudson County Construction Company for $21,140.

The superintendent of streets of Boston says that ward 24 gets about $55,000 to be expended at once in paving Freeport street and in macadamizing Adams, River and Bailey streets, as soon as they are laid out by the street commissioners.

The board of public works commissioners at Detroit, Mich., is somewhat blue over the prospect that much of the paving now under way will not be finished this fall. Probably not one-half of the paving now contracted for was ever undertaken in one season before.

The highway commissioners of the Town of Oyster Bay, N. Y., have given the contract to Twomay & Eldert to macadamize the Jericho turnpike, from the Jericho hotel to the town line, a distance of nearly two miles. The cost will be a little more than $36,000.

The Ottumwa Brick and Construction Company were let the contract for nearly 4,000 feet of street paving, which contract includes East Main street and South Ottumwa streets at Ottumwa, Ia. The contract price is $1.59 a square yard and the work will necessitate the use of 4,000,000 brick.

Second and Chess streets, of Monongahela City, Pa., will be paved and curbed. R. T. Hallans & Sons have the contract, which consists of 2,300 cubic yards of excavation, 5,900 lineal feet curbing, and 9,900 square yards of vitrified brick paving. When completed it will cost between $20,000 and $30,000.

The following is a rough estimate but will give an idea of the improvements for which contracts have been awarded by the board of public works of Superior, Wis.: Six miles of sidewalk have been built; eight miles of grading has been finished or under contract; twelve miles of paving is under way and eight miles of sewers will be built.

Arrangements have been made at Sioux City, Ia., by the paving committee and the mayor to pave Steuben, Grand and Dace streets to the Leach street bridge, across the Floyd. This arrangement will give a paved street from the business portion of the city to the stock yards district and will be a great convenience to the people of that part of the city.

The approaches to the Soldiers' Monument which occupies Circle Park, Indianapolis, Ind., will be beautified by asphalt paving. The inside sidewalk around the park will be abandoned and the outside one widened 10 feet, thus keeping the roadway 50 feet wide. Market street, from Pennsylvania to Illinois streets, North Meridian from Washington to Ohio and the four intervening sections of Circle street will be paved. The total cost of the improvement will be nearly $100,000.

At Manchester, N. H., a top dressing of crushed stone is being applied to Belmont street between Hanover and Manchester streets, Brown avenue is being improved and a portion of Maple street will be macadamized this season.

The following named streets in New York City will be paved with granite blocks: Parts of 161st, 88th, 113th and 117th streets; Amsterdam avenue, Washington, Warren, Morris, Cortlandt, Liberty, Greenwich, Albany, Carlisle, Barclay, Dey, Murray, Rector, Cedar and Fullerton Sts.; Battery place, Twenty-eighth and Thirteenth streets and Thirteenth avenue.

The usual method of laying a macadam road is to first place a layer of three to six inches of broken stone, about the size of one's fist, to be put upon the graded roadbed in dry weather. After consolidation add successive layers until the desired thickness has been obtained, all the layers except the first to be put down in wet weather or saturated with water and rolled.

George P. Clark, in writing to the *Newton* (Mass.) *Graphic*, says that in order to keep a street clean and as free from dust as possible, no street should be watered during the day, as the water does not penetrate the dust, quickly dries up, is made into dust by being driven over. Watering should be done in the evening after eight o'clock, and in the thickly settled parts of the city the cleaning should be done before seven o'clock in the morning and after six at night.

SEWERS.

A system of sewers will be built at Cobleskill, N. Y.

Monmouth, Ill., is discussing a main sewer to cost $34,000.

Colfax, Wash., is to have a new sewer system to cost $9,000.

Work has begun on a new system of sewerage at Emporia, Kan.

A sewer contract at Reading, Pa., has been awarded to P. F. Hawman at $13,542.

About 20,000 feet of 8 to 24-inch terra-cotta pipe sewers are to be laid at Nanticoke, Pa.

Bates, Touret & Welch were awarded the Webb street sewer contract at Salem, Mass., at a bid of $9,743.

New sewers will be built at Findlay, Ohio. 1,600 feet of 15-inch, 187 feet 8-inch, and 540 feet 6-inch.

Concord, N. H., has ordered the immediate construction of the sewers voted several months ago.

Joseph Bruner was awarded the contract for laying the sewer pipe at Rochester, N. Y., at a bid of $25,812.

Estimates are being prepared for a proposed system of sewers for San Jose, Cal., by the city engineer.

Plans have been prepared for a system of sewerage at Belleville, Ill., by Mr. Wickenden, of Toledo, Ohio.

The board of aldermen of Minneapolis directed the city engineer to prepare estimates for thirty-two sewers.

A sewer will be built in Fillmore street, at St. Louis, Mo., from the river west to Pennsylvania avenue, thence north to Dover straet, embracing 1,420 feet of 8-feet diameter brick sewer.

The council of Los Angeles, Cal., has adopted an ordinance for an 8 to 15-inch sewer in thirty-eight streets.

A petition to improve Elm avenue, Norwood, Ohio, by sewerage and macadamizing was awarded to the council.

The estimated cost of a sewerage system for Columbus, Ga., as per plans prepared by Williamson & Earl, is $137,903.

Vancouver has set aside the sum of $150,000 for sewerage works. Contracts have been let for $50,000 of this amount.

Twelve miles of main and lateral sewers have been laid this year at Pittsfield, Mass., on the new system being built there.

Southbridge, Mass., is to have a system of sewerage. George W. Cram has been awarded the contract to build the same.

The council of Lima, Ohio, has voted to ask the next legislature to authorize the city to issue $50,000 worth of sewer bonds.

The Portland Stoneware Co. has been awarded the contract for about ten miles of sewer pipe to be laid at Providence, R. I.

The council of Lockport, N. Y., has decided to build a system of sewers at a cost of $140,000 and to issue bonds to pay for same.

Plans are nearly completed for the carrying off of the sewage of Salt Lake City by gravitation. The estimated cost is about $250,000.

The by-law to provide $40,000 for a sewerage system at Peterboro, Ill., was submitted to the ratepayers and defeated by a majority of 147.

The proposal of F. Fornoff, Sr., for the construction of a brick sewer in Moler street and Parsons avenue at Columbus, Ohio, was accepted.

The sewer question is becoming a grave one at South Bethlehem, Pa. It has become a matter of dollars and cents against cleanliness and good health.

Edward Riley was awarded the contract at a bid of $27,097 for the repairing of the damages to Mill Creek sewer, at St. Louis, Mo., occasioned by an explosion.

The city of Colfax, Wash., has adopted the plans of W. J. Roberts, city engineer, for a sewer system to cost $25,000. 4,800 lin. ft. will be constructed at once.

Wolf & King were awarded the contract for building the Winter street sewer from Howard's Pocket bridge to the Bay of Superior, at Superior, Wis., for $14,985.67.

New sewers will be built in Marquette and Fillmore streets from Fourth to the river at Davenport, Iowa, the former being 1,600 feet in length and the latter 1,752.

Pottstown, Pa., wants a city charter to enable it to construct better sewers and make other needed improvements, which under the present borough charter they are unable to do.

An appropriation of $22,500 has been made by the city council of Nashville, Tenn., for the construction of the Lick Branch outlet sewer from Front street to the river.

The board of park and boulevard commissioners at Detroit, Mich., has recently tried the experiment of building a sewer itself without recourse to contractors. It is claimed they were quite successful. A sewer 2,708 feet long was laid at a cost of $962.

Work has been begun on the Seaview avenue sewer extension. It will extend to and through Williston street, giving the latter street a long needed sewerage accommodation.

Bids will be received at Tiffin, Ohio, until Sept. 23d for furnishing the material and building a main and lateral sewer in Main sewer district No. 17. Address the city clerk.

A sanitary sewer will be built in Woodland avenue through Glen, Avon and Hunter's park divisions and in Oxford street from Woodland avenue to Princeton avenue at Duluth, Minn.

The streets of New Orleans, La., will not be torn up before the first of October for the purpose of beginning the new sewerage system. Five years is allowed for the completion of the contract.

At Birmingham, England, the sewage of 650,000 people, 17,000,000 gallons per day, is used on 1,260 acres of land. The city spends $135,000 per year in operating the farm and receives about $100,000 for products.

A system of sewerage will be put in at Rhinelander, Wis. A civil engineer has made a survey and report in which he estimates the total cost of the system to be $155,000. The Pullman system will be used, and work will be commenced at once.

Commissioner Heintz, of New York City, has approved plans for a sewer in East 157th street from Elton to Third avenues; for one in Eagle avenue from Westchester avenue to East 149th street, and one in Walnut avenue from 138th to 141st streets.

Town Engineer Raymond, of Berkley Cal., is very much satisfied at the prospects for establishing a complete sewerage system for the section between University avenue and Rose and Gilman streets on the south, and San Pablo and the Bay on the east and west.

The sewer committee of Holyoke, Mass. voted to build a 30 inch brick sewer in Lyman street to take the place of one already constructed, which is not large enough to take off the water. It will be made with an eight-inch ring and will be about 500 feet long.

No definite action was taken by the council of Sioux City, Iowa, in regard to the North Side sewer system. Engineer Loweth, of St. Paul, in a communication stated that the cost of a system as devised by himself would be $123,440, which is a much larger sum than the council had supposed would be required.

Johnston & Dowle received the contract to build a sewer in the alley between Iowa and Lackawanna avenues, from Belknap to Ritchie streets, at Superior, Wis., at a bid of $9,183.55. Wm. Moore & Son were also awarded a $9,008.90 contract to construct a sewer in the alley between Iowa and Ohio avenues, between Ritchie and Belknap streets.

It is said that the contract for the sewerage system for Sherman, N. Y., has been let at a cost of $40,000. The system will consist of a main line running next to the lake with laterals down the hill. By means of machinery, the solids will be separated from the liquids and nothing but comparatively pure water will be turned into the lake, while the solids will be either burned or converted into a fertilizer.

G. W. Zacharias, the engineer of Santa Monica, Cal., has been ordered to prepare maps for the proposed sewer lines for the city. The cost of the work is estimated at between $300,000 and $400,000.

WATER-WORKS.

Water-works are talked of at Sylvan Beach, N. Y.

The borough of Marietta, Pa., is bound to have water-works.

Steelton, Pa., will soon be supplied with first-class water-works.

The water-works question is under discussion at Reading, Ohio.

Edmore, Mich., has voted on $21,000 to be expended in water-works.

The water-works at Fremont, Neb., will be extended at a cost of $23,601.

Work has been commenced on the water-works system at Iowa Falls, Ia.

Pontiac, Mich., will soon have a fine system of water-works in operation.

The citizens of White Pigeon, Mich., have voted in favor of water-works.

The State College Water Company has been incorporated at State College, Pa.

Philadelphia, Pa., is sorely in need of a much larger and better water supply.

The cost of the proposed water supply for Schenectady, N. Y., will be about $273,000.

The survey has been completed for the proposed system of water-works in Lowville, N. Y.

Montgomery, Minn., will extend its water mains. $3,000 have been voted for that purpose.

The people at Le Roy, Ill., have voted 160 to 46, to put in water-works at an estimated cost of $6,000.

Constantine, Mich., has voted on the water-works question and will spend $15,000 for a plant.

The Tarboro Water-Works Company has been incorporated with $60,000 capital, at Tarboro, S. C.

Keyport, N. J., has voted for water-works and Atlantic Highlands will decide the same question soon.

A. W. Walton, Rome, Ga., wishes to build water-works on the franchise plan at Cleveland, Tenn.

Petoskey, Mich., will bond for $15,000 and extend, repair, and improve, her water-works system.

D. B. Dwyer & Bros. were awarded the contract by the council of Kent, Wash., for water-works for that city.

Bids for the erection and maintenance of water-works at Cynthiana, Ky., will be received until October 11th.

The new water-works at Beatrice, Neb., is said to be a failure so far as furnishing a sufficient supply of water.

The Rathdrum Water and Power Company has been incorporated with a $10,000 capital at Rathdrum, Idaho.

The Aqua Supply Company has been given the contract for water-works at Gettysburg, Pa. The contract calls for a supply of 400,000 gallons of pure cold water per day.

It is reported that Wiley Hudson, Anniston, Ala., has a contract to build a dam for water-works at Ironaton.

A movement is on foot in Bloomsbury, N. J., to build a reservoir to supply the town with pure spring water.

The water-works plant being put in at Danville, Ind., will cost $20,000. It will be completed the first of September.

Port Gibson, Tenn., is considering the subject of voting bonds to erect water-works and an electric light plant.

The Sinclairville Water Company has contracted to supply the village of Sinclairville, N. Y., with seventeen hydrants.

Fairbanks, Morse & Co., of St. Paul, received a $13,960 contract for constructing water-works at New Richmond, Wis.

Lincoln, Neb., has voted to issue $47,000 of bonds for the purpose of extending the mains and enlarging the water-works.

Water-works improvements are under discussion at West Chester, Pa., in the way of providing a new reservoir and a new pump.

Whitestone, N. Y., is to have a new water-works system. The cost will be about $25,000, and six and a half miles of mains will be laid.

The water-works at Walden, N. Y., are to be completed by Oct. 1st. The water is to be pumped direct from the driven wells into the pipes.

Buckley, Wash., is to have a Holly system of water-works to cost $9,500. White river is to be tapped three-fourths of a mile from town.

The City Water Company, at Chattanooga, Tenn., is erecting an iron water tank 20 feet in diameter and 75 feet high, with a capacity of 175,000 gallons.

The council committee on water-works at Lawrence, Mass., has recommended that the council provide for the expenditure of $20,000 for a filtering plant.

The number of water-works in operation or under construction in the United States is 2,037, and the number of towns and cities supplied is 2,187.

The water supply of Dunkirk, N. Y., has cost the city $200,000 for twenty years and an effort will be made to curtail expenses by putting in a gravity system.

Decatur, Ind., will have water-works in the near future. Hollenbeck & Moore, of West Farmington, Ohio, have the contract for sinking four wells for same.

The Churchill Pump & Engine Co., Omaha, Neb., have been awarded the contract for water-works to be built and completed by December 1st at Woodbine, Iowa.

Five car loads of pipe for water mains have been received by the Great Falls water-works at Great Falls, Mont., for the extension of their works this season.

The people of Brookline, Mass., have voted $60,000 for a second force main and $34,000 for a 5,000,000-gallon high-duty pumping engine for the water-works.

Plans and specifications have been prepared for a $60,000 system of water-works for Neenah, Wis. The supply will be taken from an intake crib in Lake Winnebago 1,400 feet from shore. The specifications allow for 64 hydrants to be distributed throughout the city and for 20,810 feet of piping, one-half of which is to be a six-inch pipe.

A six-inch water main is to be laid on Wellington street, between Fourteenth street and University place, and a four-inch main on Morgan street, at Washington, D. C.

A water-works company is about to be formed at Glen Cove, N. Y., by several of the most enterprising citizens. The capital stock will be $50,000, which amount is already subscribed.

Over 7,500 feet of water pipe has already been laid through North Denver by the Denver Water Company, and they will ask the town for a further franchise, providing for town fire hydrants.

The Elkhart Water-works Co., at Elkhart, Ind., have recently added a new well and new machinery to its plant, which now gives them a capacity of 8,000,000 gallons of water per day.

The proposition to issue $6,000,000 in bonds for erecting new water-works at Cincinnati, Ohio, voted on the 20th of last month, was defeated by 10,000 majority out of a total vote of 30,000.

A contract has been awarded the Pierce Company of Goshen, N. Y., for the construction of a complete water supply. The supply will be taken from artesian wells, and will cost in the neighborhood of $40,000.

Another pump with a capacity of 1,500,000 gallons daily, boiler, laying of five to eight miles of mains, building an additional reservoir, etc., will be added to Winston (N. C.) Water-works by that company at a cost of $76,000.

The council of Garfield, Wash., has practically decided to put in a water-works plant embracing 1,650 feet of 8 inch mains, 1,700 feet of 6-inch mains, and 2,000 feet of 3-inch laterals, supplied by gravity from a reservoir with a capacity of 300,000 gallons.

John H. Buxton, of Laurel, Md., has secured the franchise from the town commissioners of Crisfield, Md., to erect water-works. The water will be obtained from artesian wells, if good water can be found, and if not, from the Pocomoke river or some other source. 75,000 gallons a day is to be furnished, and the amount increased as needed.

The water-works company at Houston, Tex., has closed the contract for a new engine, new pump, new boiler, and other things to be added to the works, which, when put in, will more than double their present capacity. The city will be furnished over eighteen million gallons of water daily.

The reservoir to the Atlanta, Ga., water-works covers thirty acres and has an average depth of thirty feet. It is encircled by a forty-foot driveway as level as a floor and a better idea of the size of the lake may be had when it is known that this driveway, skirting the edge, is a mile in length. The cost of this great basin when completed will be $59,000.

Nashville, Holmes county, Ohio, will have a novel system of water-works for use in case of fire. On an elevation quite higher than the highest building will be a huge water tank containing about 250 barrels of water. From the tank pipe is laid to which hose is connected that reach all over the town. Water is forced into the tank by a wind pump.

The water-works system of Alexandria, Va., has recently been extended. 5,000 feet of six-inch mains have been laid in sections where there was no water service before.

A system of water-works will be furnished Farmingham, Me. Water will be pumped over Sandy river to a stand-pipe on a hill at the north end of the village with a capacity of 250,000 gallons, thence distributed to the village. There will be thirty-four hydrants.

At the test of the new water-works at Peoria, Ill., last month, delegations were present from Springfield, Pekin, Lincoln, La Salle, and other cities. The system used is the stand-pipe and reservoir direct pressure and is declared a decided success. The object of the test was to discover both the capacity of the supply and the force of the pressure.

The largest dam in the world will be the Croton dam, Cortlandt, Westchester county, N. Y., and will be built by J. S. Coleman. It will extend across the valley of the Croton river and the entire structure will be 1,200 feet in length, 680 feet of which will be masonry. The base of the dam will be 185 feet wide and the crest 20 feet. The reservoir will have an average width of half a mile and will extend back 16 miles to the Croton Falls and will impound from thirty to thirty-four billion gallons of water.

BRIDGES.

Jefferson City, Mo., is to have two new iron bridges.

Trego county, Kan., is about to build its first iron bridge.

A new iron bridge is being built over the St. Joe river at Litchfield, Mich.

A new steel bridge will be built over Squaw creek at Fremont Center, Ill.

Warren county, Ind., will have to build twelve new bridges along her gravel roads.

A stone arch bridge will be built at Andrews street, Rochester, N. Y., to cost $75,000.

A new iron railroad bridge is being built over Hilton creek, three miles east of Marengo, Ia.

The new bridge and tunnel on the B. & O. railroad at Harper's Ferry, W. Va., have been commenced.

An iron bridge will span the Great Miami river at a point two miles south of Miamisburg, Ohio.

The sum of $25,000 has been voted for the construction of a bridge at Franklin street, Lansing, Mich.

It is estimated that the cost of a viaduct across Washington street at Bay City, Mich., will reach $52,000.

The contract has been let for an 18-foot iron bridge over Cedar creek, at Peru, Ill., and will be completed by Oct. 1st.

The new Green street bridge at Galena, Ill., will cost $5,400, and will be a high trestle bridge with ornamental portals.

A new iron bridge will be built on the National Road crossing Sugar creek near Philadelphia, Hancock county, Ind.

The Chicago Bridge & Iron Company were awarded the contract to build a bridge across the Calumet river at Halstead street, Calumet, Ill., in consideration of $6,500.

It has been decided by the commissioners to build a large bridge at Perrysville, Ohio.

Marion and Linn counties, Ore., propose erecting a new bridge across the Santiam at Mill City between the two counties.

A new iron bridge is being built at Appleton, Wis., by the Wisconsin Iron & Bridge Company. It will cost $20,850.

The city fathers of Ypsilanti, Mich., are considering the advisability of putting up a $10,000 bridge across the Huron river.

The Muskegon river has been spanned by a new bridge at Bridgeton, Mich. The bridge is one-sixteenth of a mile in length.

The county commissioners of Stark county, Ohio, will build a bridge across the Tuscarawas river at Short street, Massillon.

The government will be called upon to pay $22,000 for four iron bridges across ravines at the military post at Fort Sheridan, Ill.

Mr. McCarthy, of Sherbrooke, Ind., was awarded the contract for building the masonry of the three new iron bridges at Knowlton, Ind.

Plans and specifications are prepared for the three new bridges to be built in Whatcom county, Wash., at Everson, Nugent's Ferry, and Lynden.

The bridge spanning the creek at Melrose, Ore., has been completed by Contractor E. E. Emmitt. The structure is a good, substantial one, 212 feet in length.

The new bridge of the C., B. & Q. R. R. building at Bellefontaine Bluff over the Mississippi river, will be one of the longest bridges that cross the western waters. It will have eleven spans.

The contract for constructing a new wagon bridge over the Skagit river at Mt. Vernon, Wash., has been let to Westerman & Yeaton, of Seattle. When completed, the bridge will cost $29,000.

The G. & J. Brown Manufacturing Co., Belleville, Ont., has completed a new steel bridge over Jeanette creek, ten miles from Chatham, Kent county. It is constructed on steel piles instead of oak.

Plans for the iron bridge over the Red River at Winnepeg, Ont., to connect the Norwood property with the city have been approved and the work of construction will be commenced probably this month.

The Jackson Bridge and Iron Company, of Jackson, Mich., was awarded the contract for the steel girder bridge over the Kalamazoo river at Kalamazoo, Mich. The cost is to be $2,550.

A bridge company with a capital of $1,000,000 has been organized at Yankton, S. D., for the purpose of constructing a railroad and wagon bridge over the Missouri river at that point.

The Toledo Bridge Company, of Toledo Ohio, has the contract for building a highway bridge across the Delaware river at Point Pleasant, Pa. The bridge will consist of four spans, 175 feet 6 inches each and one span of 179 feet 7½ inches.

The city council of St. Cloud, Minn., voted in favor of the building of a new bridge across the Mississippi river at St. Germain street. It is to be an iron structure with a 24-foot roadway and two 4-foot walks and will cost between $34,000 and $40,000.

The Pecos high bridge over the Pecos river, Texas, is entirely covered with galvanized iron for the purpose of protecting the wooden guard rails and ties from fire. It took about 60,000 square feet of iron to cover the bridge and about 1,000 yards on each side of the immense structure.

A new draw is to be put in the H. & St. Joe bridge over the Missouri river at Kansas City. It is to be constructed entirely of steel, and when completed the bridge will be practically a new one, as the remaining portion was constructed with steel some time ago. The cost of the improvement will be in the neighborhood of $60,000.

The proposal to build a third bridge across the Mississippi river at St. Louis, Mo., has taken definite shape. It has been before the public for several years and now local and Cincinnati capitalists are figuring on the work. The new bridge is to be south of the Edas bridge, and according to the present plans will cost about $6,000,000.

A civil engineer of Kansas City, Mo., designed a bridge for Duluth harbor which will do away with the central pier as well as several other difficulties and is something decidely new in engineering circles. The bridge is designed to consist of a simple truss span 250 feet long, which can be lifted to the height of 140 feet above the water by the means of two steel towers 185 feet in height, to be placed one at each end and carrying at their tops pulleys 15 feet in diameter. Over these pulleys 48 steel ropes 1½ inches in diameter pass; one end to be attached to an end pin in the truss and the other to the counterweight. The design was approved by the war department, but the vesselmen protested strongly against a bridge of any kind, and succeeded in making their point at Washington, so that the project was abandonded.

STREET LIGHTING.

Electricity is to light the town of Sherwood, Mich.

The town of Newman, Ill., wants to sell its electric light plant.

The sum of $15,000 has been voted for an electric light plant at St. Clair, Mich.

An electric light plant will be erected at Charlottesville, Va., at a cost of about $20,000.

St. Thomas, Ont., is agitating the question of municipal control of the electric light system.

Bids will be received until Sept. 20 for lighting the city of Pawtucket, R. I., for one, three or five years.

At Searcy, Ark., the city authorities have been considering the advisability of putting in an electric light plant.

St. Clair, Pa., will have an electric light plant of forty 2,000 candle power arc lights and seven hundred and fifty 16 candle power incandescent lights.

The Perry Electric Light and Power Co. has been awarded the franchise, and a contract for five years for 20 arc lights at $52 per light per year for the streets of Perry, N. Y.

It is reported that the Chicago Edison Co. is about to build the largest electric light and power plant in the world. The total horse power of the present plant is about 8,000 and the proposed horse power is 25,000.

The citizens of Middletown, Pa., have voted to light the streets by electricity.

A company has been formed at Logan, Ohio, with a capital stock of $15,000 for the purpose of manufacturing and furnishing electricity for lighting purposes.

The city of Seattle, Wash., will furnish the building for the new electric plant which will furnish lights for the streets, public buildings and public grounds of that city.

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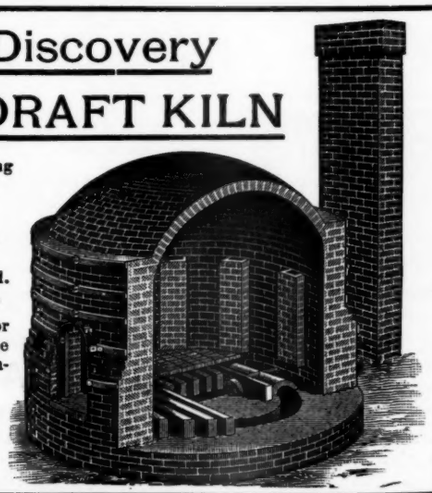

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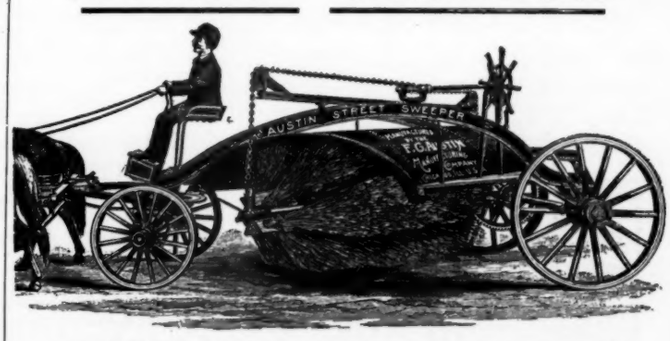

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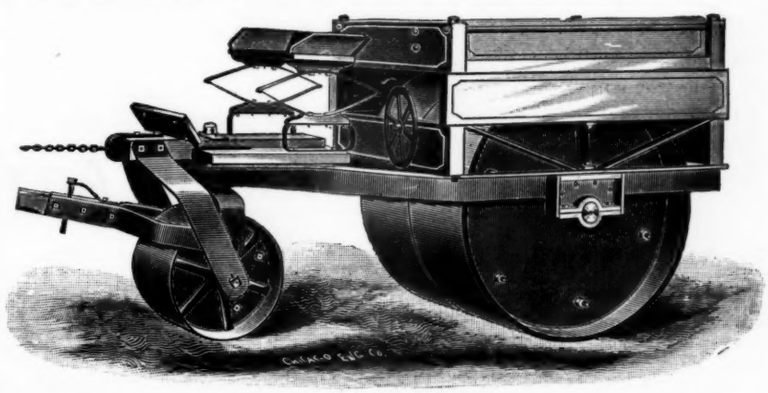

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ESPECIALLY ADAPTED FOR STREETS, WHARVES, RAILROAD DEPOTS, PIERS, ROADWAYS OF BRIDGES, MARKET HOUSES, BREWERIES, WAREHOUSES, ETC., ETC.

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Greatly reduced cost as compared with Granite Curbing, which it will, in time, entirely supplant, as it is superior in appearance and finish.

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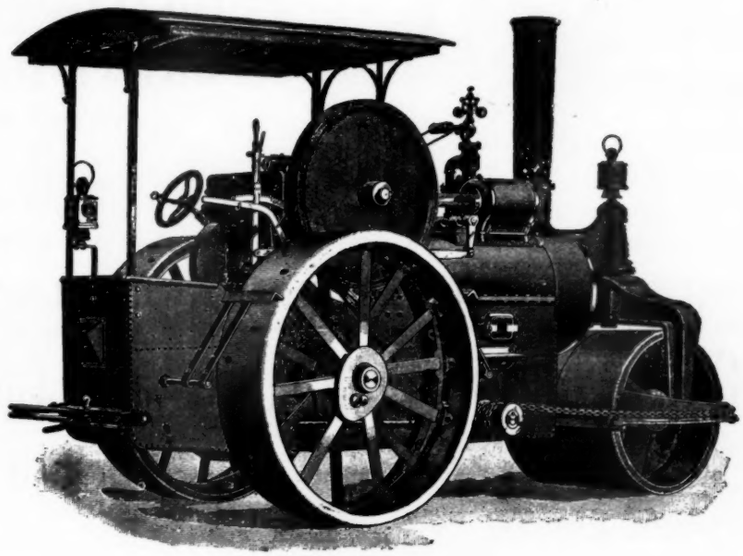

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Among the special points of advantage peculiar to this roller and not found on other rollers are:

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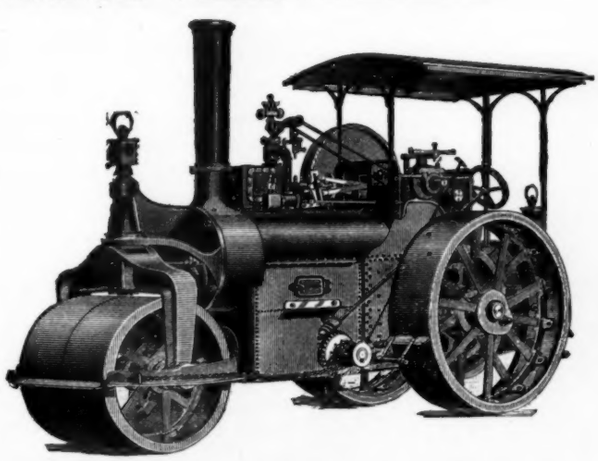

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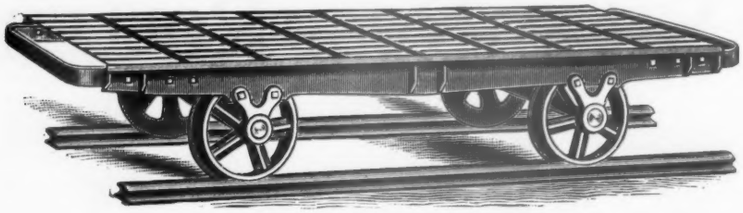

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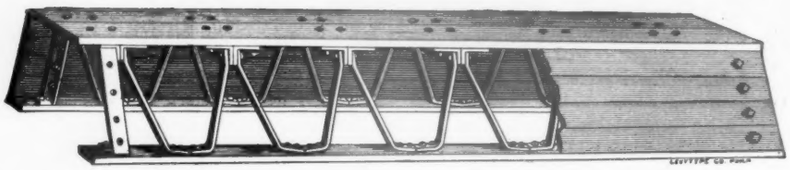

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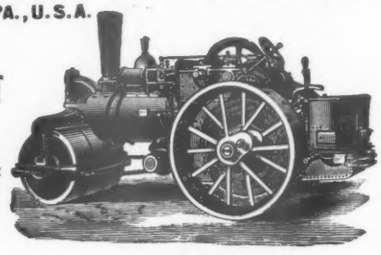

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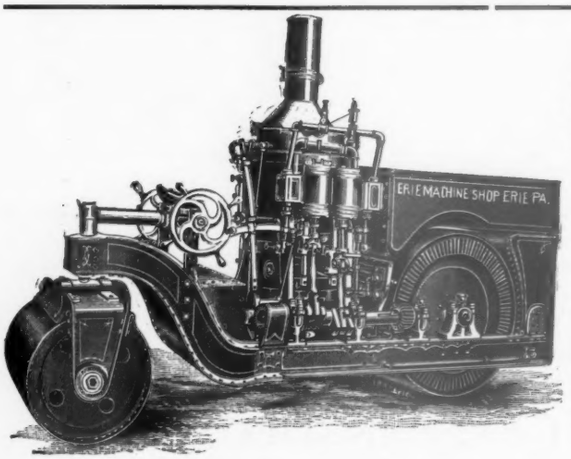

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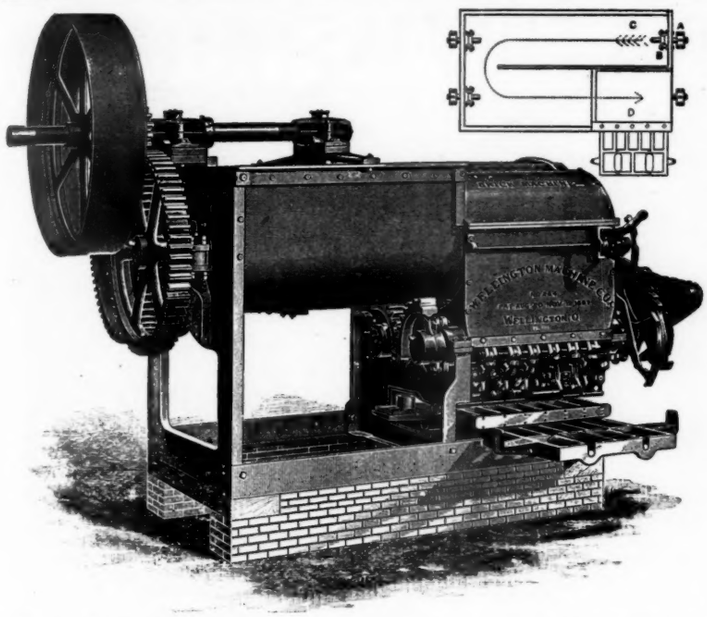

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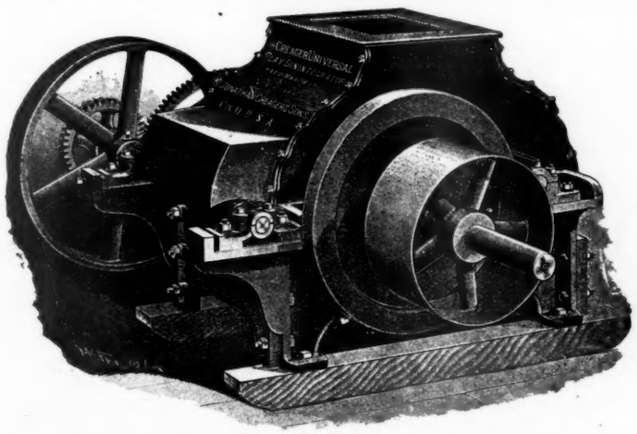

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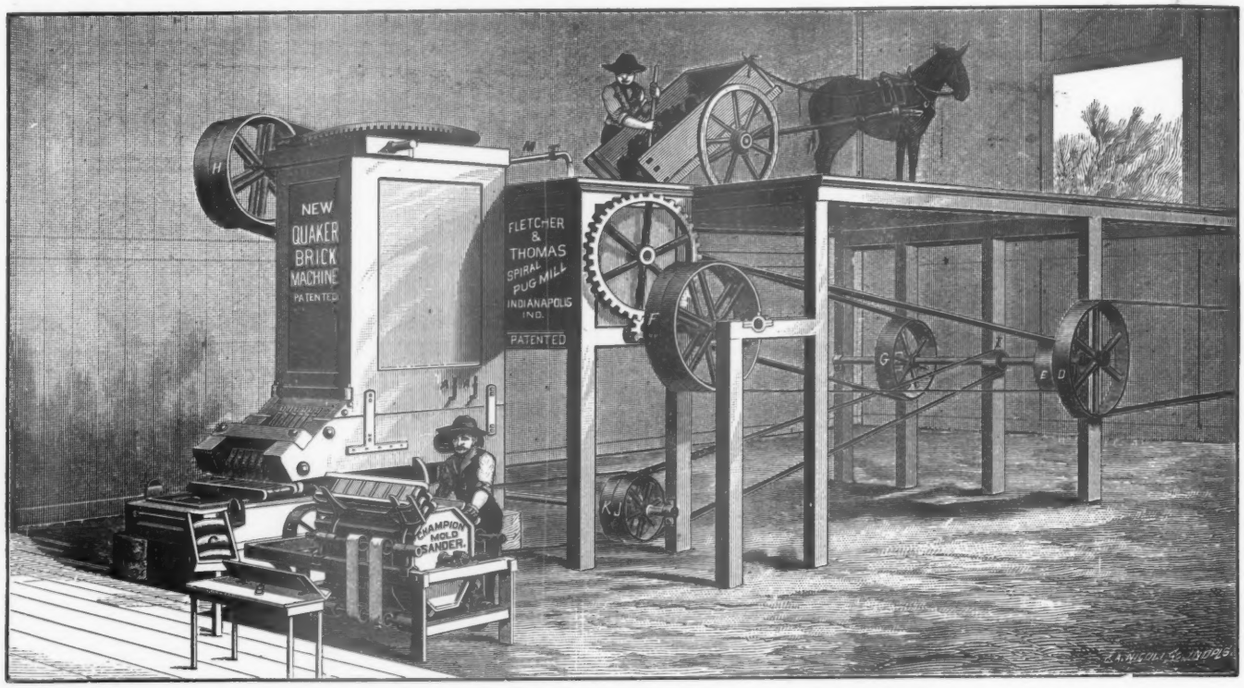

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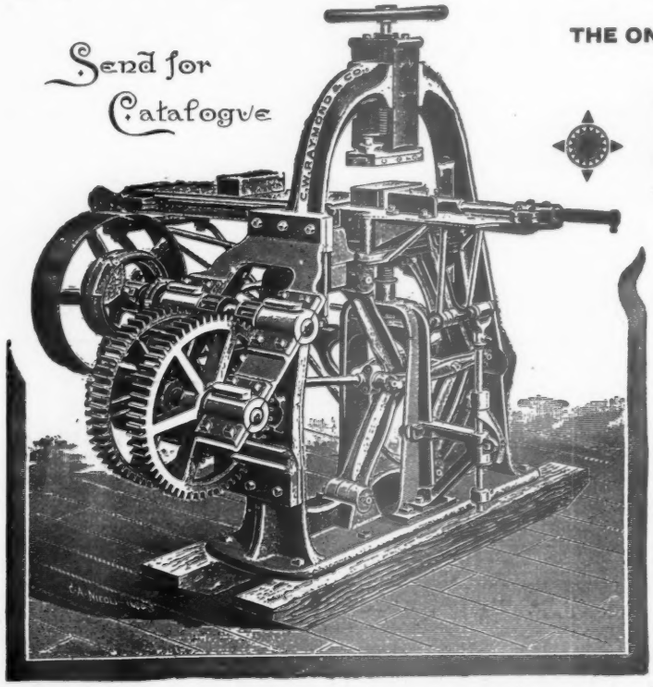

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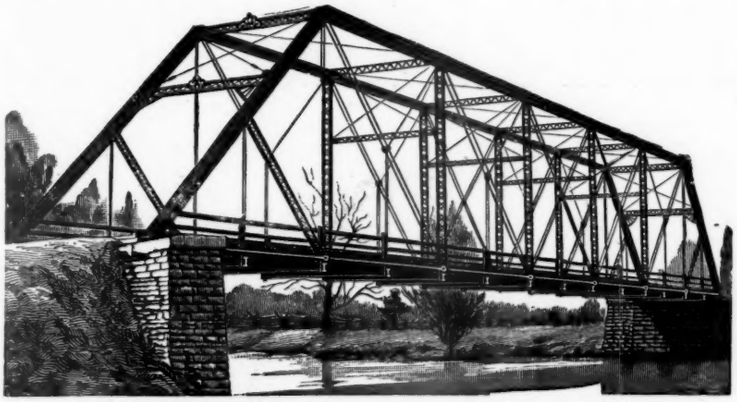

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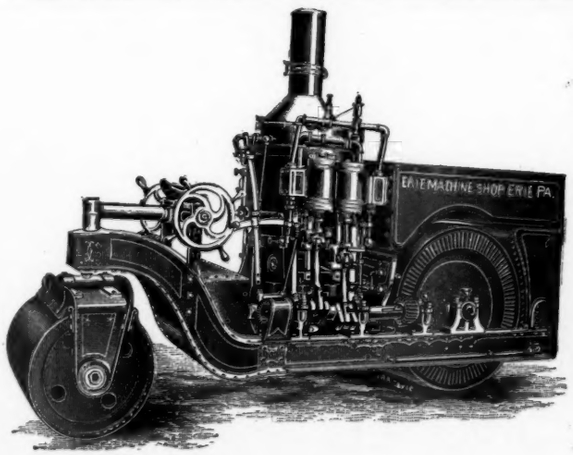

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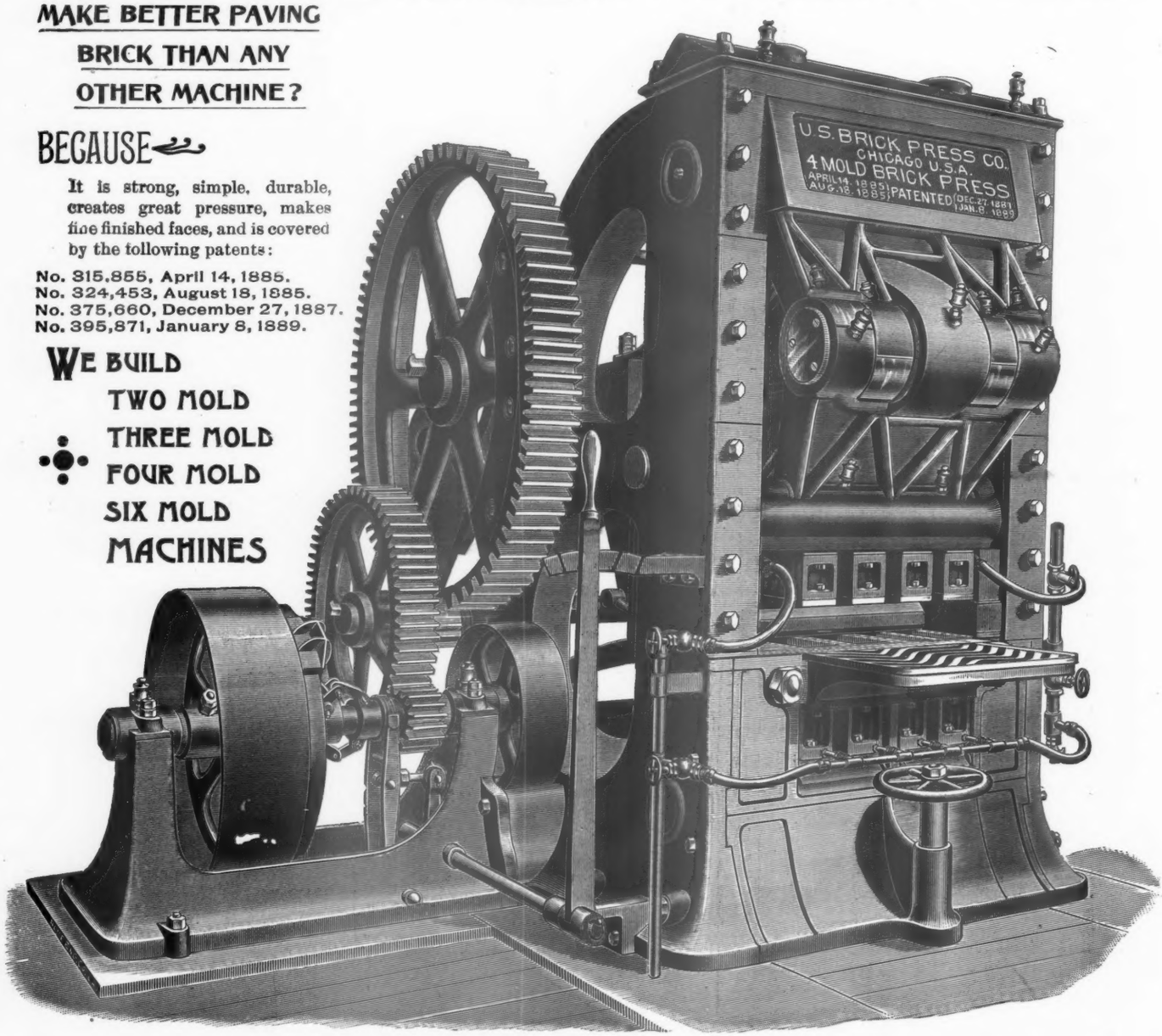

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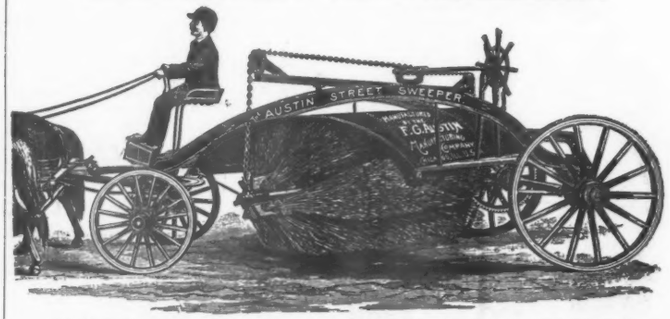

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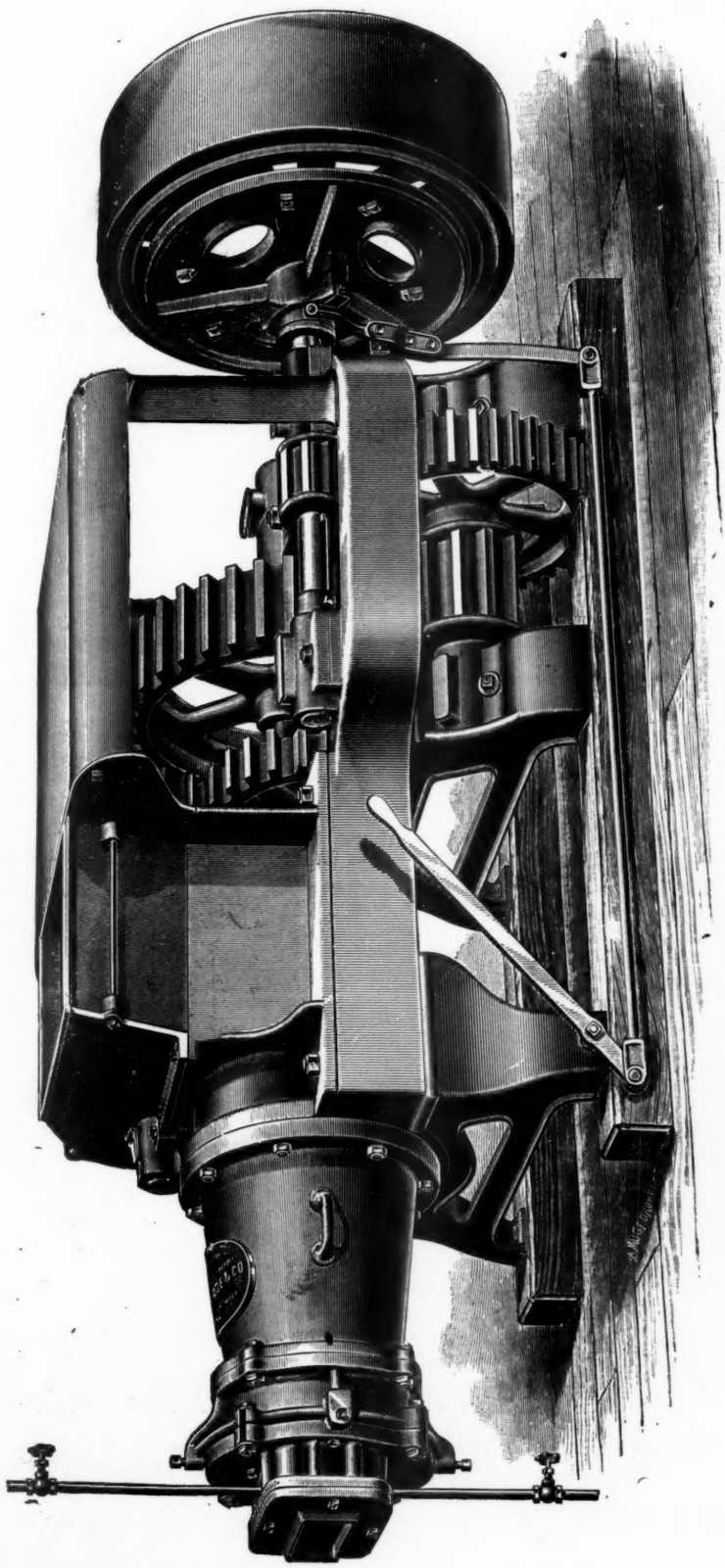
F. C. AUSTIN MANUFACTURING CO CHICAGO, ILL.

The New "Ohio" Brick Machine.



THE MACHINE IS WELL MADE.

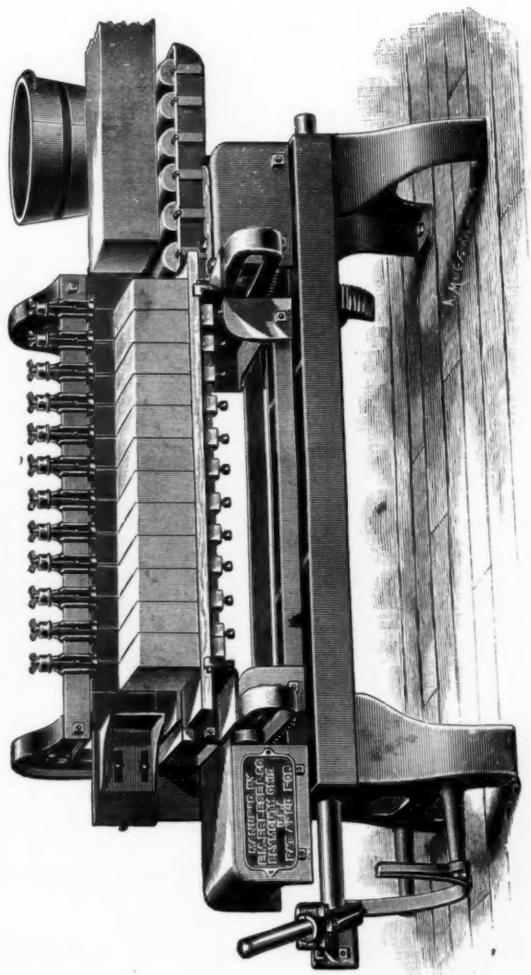
AND IS SUBSTANTIAL AND SERVICEABLE.

IT HAS special advantages not found in others, and will produce brick of the best quality at the lowest cost.

PARTICULARLY WELL
ADAPTED TO THE MANUFACTURE
OF STREET PAVING
BRICK OF THE GREATEST DENSITY.

FOR FURTHER PARTICULARS, ADDRESS

E. M. FREESE & CO., GALION, OHIO.



Capacity: Actual vs. Estimated

OF overestimated brick machinery, it is refreshing to learn of outfits in operation actually outdoing manufacturers' estimates.

YET SUCH THINGS DO OCCUR.

The Weckler-Prussing Brick Co., Chicago, Ill., with a Penfield No. 15 Auger Brick Machine (rated capacity 5,000 to 7,000 brick per hour),

averaged for the two weeks ending September 3d, an actual product of **7,586** brick per hour; only a fair sample of their regular product.

The Buckstaff Bros. Brick Co., Lincoln, Neb., use two Penfield No. 10 Auger Brick Machines (rated capacity 30,000 brick daily). They say:

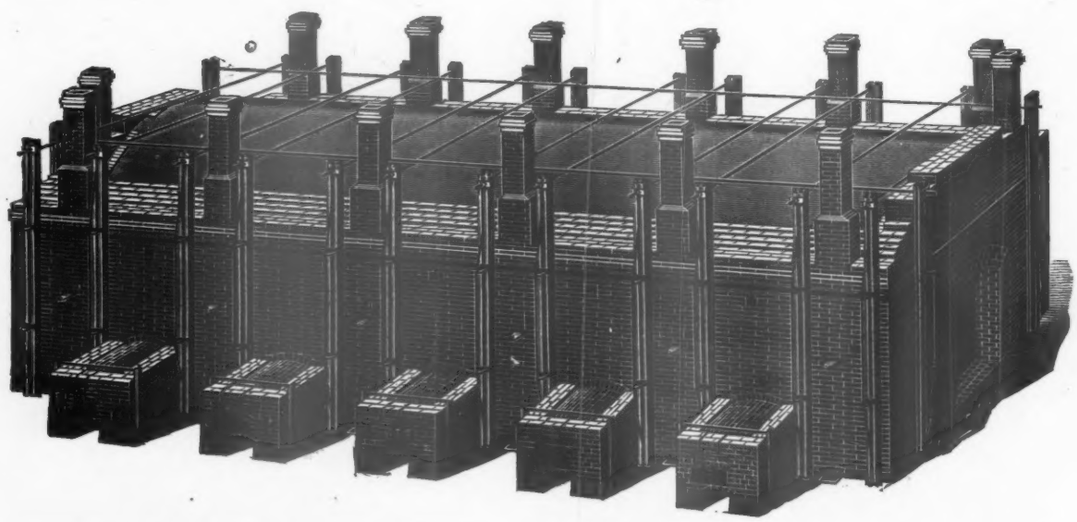
"Each machine is averaging about **50,000** per day, which is away above our expectations, and we are more than pleased with the work the machines are doing."

If you buy a PENFIELD Machine, you get the capacity you pay for.

Capacity and results are GUARANTEED.

J. W. PENFIELD & SON,
Willoughby, Ohio, U. S. A.

The ·:· Eudaly ·:· Kiln



Is No Longer an Experiment. Burns All Hard

This kiln is used by a majority of the largest STREET PAVING BRICK PLANTS in the country. It has no superior for FINE PRESSED OR FRONT BRICK. For further particulars

Address W. A. EUDALY, 64 Johnston's Buildings, Cincinnati, O.